The

Electrical Review

VOL. CVI. APRIL 11, 1930. No. 2733.

THE OLDEST ELECTRICAL PAPER. ESTABLISHED 1872.

Published every FRIDAY, Price 6d.

Chairman and Joint Managing Director: G. H. ALABASTER, Companion I.E.E.

Technical Editor: C. O. BRETTELLE, M.I.E.E.

Joint Managing Director: E. A. GATEHOUSE, M.I.E.E., A.M.Inst.C.E.

Commercial Editor: A. H. BRIDGE.

Manager and Secretary: E. S. MIDDLETON

OFFICE: 4, LUDGATE HILL, LONDON, E.C.4.

Telegraphic Address: "AGEEKAY, CENT, LONDON." Code, A B C. Telephone No. Central 8871 (5 lines).

The "Electrical Review" is the recognised medium of the Electrical Trades, and has by far the Largest Circulation of any Electrical Industrial Paper in Great Britain.

SUBSCRIPTION RATES, Postage Free: United Kingdom, £1 14s. 8d.; Canada, £1 12s. 6d. Colonial and Foreign, £2 1s. 6d. per annum. Cheques and Postal Orders on Chief Office, London) to be made payable to THE ELECTRICAL REVIEW, LIMITED, and crossed "Midland Bank, Newgate Street Branch."

For List of Foreign Agents for the ELECTRICAL REVIEW see Advertisement Supplement.

Contents:

	PAGE
The Domestic Rate	669
The "Follow-up" Method	670
The L.N.E.R. Electrification Scheme	670
French Manufacturing Conditions	670
Problems of the Electrical Industry, by A. G. Beaver *(illus.)*	671
Jewellers' Furnaces, by R. Galland	672
A Dock-lighting Scheme *(illus.)*	673
Paris Agricultural Show, by R. B. Matthews *(illus.)*	675
Electric Cable Jointing, by L. A. Gripper *(illus.)*	677
The Prince Edward Theatre *(illus.)*	679
Electricity for the Home, by G. E. Moore	681
Reviews	682
Business and Industrial Notes	683
Lighting and Power Notes	687
Tramway and Railway Notes	688
Telegraph and Telephone Notes	689
Radio Notes	690
Contract Information	690
Forthcoming Events	691
Notes	692
Our Personal Column	695
Financial Section—	
New Companies Registered	696
Official Returns of Electrical Companies	697
Financial Section—*contd.*	
City Notes	697
Stocks and Shares	699
Electrical Exports of Germany	701
The Situation in China	702
Railway Electrification in Costa Rica *(illus.)*	703
The Barton Power Station, by H. L. Guy and H. C. Lamb *(illus.)*	704
Power-Station Plant, by W. J. Oswald and E. W. Greenway	705
The Ideal Home Exhibition *(illus.)*	706
New Electrical Devices, Fittings, and Plant *(illus.)*	710
The Hardness of Electro-deposits	711
Radio Direction-finding, by R. H. Barfield	711
Indian Electrical Notes	712
Legal	712
Parliamentary News	713
Electric Furnaces	713
Correspondence—	
The B.E.A.M.A. and the Universities	714
Bulk Supply Charges	714
Published Specifications	715
Trade Mark Applications	715
New Work for Contractors	716

The Domestic Rate.

IN our issue of November 15th last we included as a special supplement a list of authorised undertakings making a charge of 0.5d. (or less) per kWh, with or without a fixed charge in addition. In those areas all-electric houses become practicable to all whose incomes allow them to pay more than the minimum possible to secure adequate heating service (including water heating) without the attendant disadvantages of dirt and labour.

We have now extended the list to cover undertakings charging 1d. (or less) per kWh and this list forms a special supplement to the present issue. Some of the particulars given, so far as we are aware, have not been previously published in this form and will, we believe, be of interest to all classes of readers. At 1d. per kWh electricity is usually economical, taking all things into account, for cooking and intermittent heating. It is not low enough for an adequate supply of hot water at a reasonable cost, but many supply authorities offer a special tariff for energy taken off-peak for this purpose.

The list gives the basis of the primary charge, where such exists, though this is not of great importance to long-hour users and frequently represents only the average additional cost of the lighting consumption above the amount payable at the secondary rate. Undertakings are arranged in alphabetical order in groups classified in accordance with the secondary charge.

Figures showing kWh per head are given, and the extent to which the output is effectively spread over the population can be ascertained from the consumption per consumer for all purposes. The character of the domestic development, whether intensive or extensive, can also be measured by relating the kWh used per domestic consumer to the percentage of houses wired. The effect of the hire or hire-purchase of apparatus and assisted wiring schemes can also be studied, but it must be borne in mind that many of these schemes have only recently been introduced and also that in some instances the present tariffs have not been in force long enough for useful results to be ascertained. In some cases a higher charge is made to consumers in outlying districts; no account has been taken of these as the number of persons affected by the increase is generally small, and their

inclusion would give a less favourable view than the conditions would warrant.

The price of gas, as the most formidable competitor of electricity for heating and cooking, is also tabulated. Gas is still the most important competitor for lighting, and the history of the rivalry of the two services will possibly be repeated in uses other than lighting. Not 20 years ago discussions were common as to the relative costs of the two methods of illumination. This kind of discussion interests no one now; if electricity is available, it is used for lighting, without attempt to draw up a comparison of costs with gas. At the present time, however, a comparison of costs for heating and cooking is strictly relevant.

As in the case of our previous table, small undertakings come out surprisingly well, some 20 per cent. of the total number having a maximum load of less than 2,000 kW, Amble, with 83 kW, being the least. Hamilton and Sale are two of the smallest included, and they charge a secondary rate of 0.5d. per kWh.

Of the others, Worcester—by no means a large undertaking as we understand the term to-day—heads the list, but the lowest secondary charge is the 0.375d. per kWh for all purposes offered by Stoke-on-Trent after a reasonable consumption at 1d. per kWh. Our largest cities, it is pleasing to note, also occupy honourable positions.

It is possible that some undertakings whose tariffs entitle them to inclusion in the supplement have been inadvertently omitted; we shall be glad to rectify any such omissions at a later date.

We take this opportunity of thanking the chief engineers and managers mentioned in our list for their co-operation in its production.

The "Follow-up" Method.

We used to hear a great deal concerning the merits of the "follow-up" system as applied to up-to-date business-getting campaigns. The potential user of electricity or the potential purchaser of electrical goods and apparatus received a document intended to arouse his interest; if he showed no signs of stirring from his slumber within a given period he was attacked a second time and with a startlingly convincing folder of a follow-up type telling him what an opportunity he had missed; next came a forceful slogan, or a canvasser filled to overflowing with persuasiveness, argument, and even practical demonstration. The practice is highly to be commended as part of the whole scheme of efficient salesmanship which every firm in the electrical industry and trade ought to be applying to-day.

To send out a first circular and leave that to do its work alone is like having a sudden fit of advertising—publishing through the Press one announcement to the trade and believing that that will do the whole trick and bring in big volumes of business. First announcements of the kind have sometimes worked wonders it is true, have helped to build up new business, and have taught the value of an advertising medium—but first announcements require to be followed up again and again and persisted in as a continuous measure for bringing one's name and one's products before buyers.

The follow-up practice is capable of very effective application in connection with exhibition efforts. In our own experience we have used up a pack of cards—visiting cards we mean—by placing them one by one on a desk, a piece of apparatus or machinery, or some other exhibit, to show that in the absence of the exhibitors' representatives the Electrical Review has called to learn something about the exhibit. No doubt in the ordinary course of things the card has been placed among the day's collection and passed on to somebody, but with what result? About one in fifty respond to the implied invitation to communicate with us. We are reminded of such experiences by a letter written to one of the London daily papers by a correspondent who visited the British Industries Fair (London) and the Leipzig Fair, and gives a brief comparison of his experiences. At both places he had discussions with manufacturers or their representatives regarding their products and prices, and then left his card so that lists and prices might be forwarded. He is now receiving communications from Germany, but so far not a single British manufacturer has followed up his visits to the B.I.F. with a postal effort to cement the relationship formed by personal contact. It has been shown that efforts at some previous Fairs in this country have yielded orders "after many days," but why be content to wait? Far be it from us to draw deductions unfavourable to British trading originality and activity if it can be avoided, or to arrive at a general conclusion from one critic's isolated example of inactivity, but our experience may be cited here, for we ourselves sent a special commissioner to Leipzig so that the British electrical trading community might be kept informed of Continental developments, and we continue to receive German communications as the result.

What more need we say? Call it what we like, the "follow-up" system in some form or other—by circular, by persistent advertising, and by correspondence—must be employed as a regular weapon by the electrical or other business-seeker.

The L.N.E.R. Electrification Scheme.

The traffic facilities of North London and beyond have not kept pace with the rapid development of the area, but now it seems as though the transport undertakings intend to more than make up the deficiency. A Commons Committee has approved, in principle, of the extension scheme of the "Underground" group, which will carry the Finsbury Park line on to Cockfosters, and at the same time has urged upon the London & North-Eastern Railway Co. that the approval should not interfere with that company's proposal to electrify its suburban lines serving the Northern regions.

Following upon this the L.N.E.R. last week published particulars of its proposals, which involve the conversion of 60 miles of route, or 173 miles of single track. The scheme, similarly to that of the "Underground" group, is very necessary, and will not only prove a boon to the long-suffering population of the districts concerned, but will provide a handsome measure of employment in which the electrical industry will participate to a large extent.

The carrying-out of the railway company's proposals is contingent upon the receipt of a grant from the Development Committee, and we feel sure that the plan is one which should secure that Committee's favourable consideration.

French Manufacturing Conditions.

In the course of a recent survey of the French electrical manufacturing industry, Mr. Davezac, of the Syndicat, Général de la Construction Electrique, stated that the various elements entering into the costs of production were at present experiencing a continued upward movement, which was a cause of serious concern to the French electrical industry. Notwithstanding the fall which had taken place in the past few months, the prices of the principal raw materials used in the electrical industry were still materially higher than at the beginning of 1929. Between January, 1929, and January, 1930, for instance, copper rose by 15 per cent. and pig iron by 10 per cent.

It was also stated that the persistent insufficiency of labour was being reflected in a continual increase in wages. Between January, 1929, and January, 1930, the index of wages in the electrical industry had risen from 182 to 213 or by 16.4 per cent. This shortage of labour was not due, as was sometimes alleged, to exceptional activity in the manufacturing industry, but to war losses and the decline of the birth rate during that period. In conclusion, the report stated that the private efforts which were being put forth with a view to reducing the costs of production, by means of measures of rationalisation, would be insufficient if they were not supported by action on the part of the State in the direction of the grant of considerable relief in fiscal burdens, &c.

Problems of the Electrical Industry.

Following upon the recent studies of conditions in the industry contributed to the Electrical Review by prominent electrical men, the author stresses the need for individuals and firms to join their appropriate associations as a preliminary to complete co-operation.

By A. G. BEAVER.

(Chairman of the Electrical Merchants' and Manufacturers' Association).

THE thoughtful article contributed to the Electrical Review a week or two ago by Mr. J. A. Crabtree* proved very interesting reading to those who spare a little time and thought for the general trend of affairs in the electrical industry. Of course, Mr. J. A. Crabtree only gave expression to views which many of us have been thinking and have foreseen for a long time past.

There is no doubt that the passing of the 1926 Electricity (Supply) Act may prove anything but a "blessing in disguise" to many sections of the industry, whether they be those of supply engineers, manufacturers, wholesalers or contractors. Upon their adaptability to the new conditions created will depend the ultimate success or failure of the individuals or firms concerned.

The keynote of and responsibility for good or ill rests in a very large measure with the municipal supply engineer, especially if, owing to the national grid scheme he loses his *locus standi* as a trained technical engineer and must perforce become a commercial engineer. His job will henceforth be to create sales of appliances which will absorb and bring an ever-increasing load on to his mains, the power for which is brought to his door with little or no responsibility on his part. This is a perfectly legitimate proceeding, and one which will enable him to fill his niche in the industry with advantage to everyone concerned and "be loved by all." But what of the other side of his activities: the wiring installation necessary when the appliances and fittings are sold?

Many engineers have arrangements with the local electrical contractors to carry out such work; again, quite the proper course to pursue. Others, having their own wiring departments, enter into direct competition with the contractor (who is generally a ratepayer in the district also) for such work. Again, quite legitimate so long as the competition is fair and square. Others have alternative arrangements, especially where housing scheme installations are being planned. The contractor is offered the work in competition, but the supply authority stipulates that all the wiring materials and accessories must be purchased from it at schedule rates, which are specified. There can be only one reason for this: that the supply authority expects to make a profit as a wholesale trader.

L. C. Smith] [*London.*

Mr. A. G. Beaver,

Chairman, Electrical Merchants' and Manufacturers' Association, and Managing Director of the Sun Electrical Co., Ltd.

Now I venture to suggest that when the 1926 Electricity Act was passed and the famous Clause 48 was agreed to by the various associations in the electrical industry, such a course of action was never contemplated. It is true that the clause visualised that sales would have to be made to the contractor at trade prices, but all the arguments that I ever heard (and I was a member of the Committee) related to showroom sales and the like. There is no real necessity for the municipal supply authority to enter this phase of the business: the supply of wiring materials at competitive prices can well be left to the various manufacturers and wholesale distributors.

Take the business side away from the contractor and what has he to sell but his labour? Does one get the best out of a man who has only his labour to sell? All the initiative which comes of business-building is lost, and with it the creative faculty for good work. What will the ultimate end be of the contractor forced into such work? The answer is not far to seek.

What of the wholesaler? What will be his position if such a state of trading is prevalent? None but, shall I say, the national wholesaler or merchant whose business is big enough to warrant his making large purchases or contracts will be able to accord the necessary discount to enable the supply authority to make a profit on such

* "The British Electrical Industry during the Next Decade," by J. A. Crabtree; Elec. Rev., March 4th, p. 479.

sales. What will the less fortunate wholesaler or factor do? He will not lightly give up the struggle. While the manufacturer is content to give preferential terms on orders of infinitesimal value to all and sundry who claim to be wholesalers, so long will he carry on, but he will be driven to a new clientèle: the alleged "trade-user" class.

The work which the E.C.A., the Wholesalers' and Manufacturers' Associations have been labouring at for so many years will be set at nought. The alleged trade-user class already in the view of most of the leading firms and associations much too large, will assume alarming proportions. Apart from this a class of electrical trader, the motor garage owner, is being developed, due in the first instance perhaps to the advent of radio, and the entry into this business of the motor accessory wholesaler. In the early days of radio such firms were quick to see the general apathy of the electrical trade proper, and turned to the customers already on their books. It was easy business with the public falling over one another for supplies. Can you blame them if they turned their attention also to the electrical installation side? The transition is easy, even if a little knowledge is dangerous, and dangerous it undoubtedly will prove to be in many cases; but the legitimate electrical contractor suffers.

Is not the present state of affairs due to the selfishness of the individual, each one fighting for his own end, ruthless competition, cutting of prices and therefore profits, and, in the endeavour to make both ends meet, scamping the quality of the work? This is not all. It is so easy to start in business and call oneself an electrical contractor or wholesaler or even electrical manufacturer, with little or no business training. Not very much capital is involved in the label, and very often there is not any, but just a trust in luck. No qualifications appear to be necessary and none are demanded. Such experiments are frequently costly, especially to the creditors.

Now what is the remedy? Surely one can be found. Can we not find it in the co-operation of the various sections of the industry? There has been a good deal said of late regarding rationalisation. Co-operation in the sense that I view it would be to rationalise the activities of each section, manufacturers, wholesalers, municipal authorities, supply companies, electrical contractors and retailers: co-operation which does not destroy initiative. Each section has a definite niche and a definite part to play, conserving to all a proper profit without poaching on the others' preserves, and withal without increasing prices to the user.

It requires a long and broadminded view. Such an outlook cannot be obtained by a policy of splendid isolation. It requires an interchange of thought amongst one's fellows which can only be achieved by meeting one another on a common basis.

I believe that to-day there is an association peculiar to every professional or commercial phase of the electrical industry. Certainly there is one applicable to every commercial section indicated above. Is it too much to suggest that it behoves every manufacturer and trader *in his own interests* to ally himself to the association whose special job it is to look after his section of the electrical industry? One could obtain real co-operation in this way. It is because of the large numbers who stand aloof that real progress is so long in coming.

The associations are in being. There is even a committee sitting, known as "Committee D," representative of all associations charged with the specific job of drawing up a code of ethics of trading upon which to base a general agreement. Its labours are, however, hampered because no one section can claim to be fully representative. It is the non-associated firms who are the drag on the wheel. Just as to-day there are many large firms with more or less common interests who find it necessary to combine and pool their resources, so also is it imperative that every manufacturer and trader should join his respective association if he wishes to make progress and live.

I am sure the Editor of the Electrical Review will be pleased to afford any information that is desired by inquirers as to the names and addresses of the various associations.

As suggested in Mr. Beaver's last paragraph, the names and addresses of the leading associations of the industry are given below:—

The Electrical Contractors' Association, 15, Savoy Street, Strand, W.C.2.

The Electrical Wholesalers' Federation, 19-21, Hatton Garden, E.C.1.

The Electrical Merchants' and Manufacturers' Association, 118-120, Charing Cross Road, W.C.2.

The British Electrical and Allied Manufacturers' Association, 36, Kingsway, W.C.2.

The Incorporated Municipal Electrical Association, 38, High Street, Croydon.

Jewellers' Furnaces.

Some conditions in which small electric resistance furnaces have proved to be economical.

By R. GALLAND.*

THE construction of a manufacturing jeweller's furnace based on metallic resistance is a matter of material difficulty, as temperatures of the order of 900 deg. C. (1,630 deg. F.) are often required; while 1,450 deg. C. (2,640 deg. F.) is the operating limit of the best nickel-chrome resistance alloys.

Mr. A. Rousselet, engineer to the firm of Marret, Bonnin, Lebel & Guieu, of Paris, started investigating the question ten years ago; the first furnaces were constructed in 1921, and in 1924 all the coke furnaces in the workshops of the jewellery-making firm in question were replaced by electric furnaces. The result has been a material economy.

This firm has now in operation 37 furnaces in its workshops in and around Paris. Some of the furnaces have a capacity equal to that of two fists; the largest types take laminated sheets of one square metre surface, also articles of drawn wire, and of tubular form. Certain processes require treatment in a vacuum or in a given gaseous atmosphere, arrangements for which can be easily and exclusively made by the employment of electricity. Experience shows that electricity has a definite advantage in cases in which the interior volume does not exceed 50 cubic decimetres (1.75 cu. ft.). When the metal can be subjected to a fierce heat without danger, a gas furnace is more advantageous above a certain capacity; but when the quantity of metal to be treated is small in comparison with the area of the furnace, for example one ton of precious metal per day with a furnace area of 1.3 sq. metres, then electricity may in some cases still prove to be advantageous. Coke furnaces which consume 75 fr. (about 12s.) worth of fuel per 24 hours require a supervising service for night work, whereas when replaced by electric furnaces the cost for energy has been 54 fr. (about 9s.), the night attendance being done away with. For temperatures not exceeding 1,100 deg. C. nickel-chrome resistance elements are used. With very small furnaces and elements of platinum a temperature up to 1,500 deg. C. is used.

Agglomerate resistances in a cylindrical form with water-cooled bronze terminals are used in connection with furnaces with a material output. The crucible is placed inside the cylinder; with this type temperatures up to 1,450 deg. C. are obtained, and such furnaces have given satisfactory and regular service. The jewellery company in question uses 38,000 kWh per month for such duty, the combined installed capacity in furnaces being 450 kW, and the average loading 150 kW. The furnaces are used not merely for melting but also for annealing work, some of them taking 50 kW each.

* From the Propaganda Bulletin of the Ap.-El. Society of Paris, March, 1930. Contributed by Major Theodore Rich, A.M.I.E.E.

A Dock-lighting Scheme.

A comprehensive system of high-intensity illumination has been adopted for the dock areas of the Port of London Authority.

THE Port of London Authority, which was constituted in 1908, and which controls and administers the five groups of docks in the port and the tidal portion of the River Thames, a distance of some 69 miles, possesses a total dock area of some 3,688 acres, with a water area of about 722 acres. The total lineal quayage, including the Surrey Canal, is some 45 miles in length, and warehousing accommodation is provided for over one million tons of merchandise. Some 650 cranes, the largest of which has a lifting capacity of approximately 150 tons, are used for handling the merchandise. There are also ten graving docks, with accommodation for some of the largest ships afloat. The shipping entering and leaving the port during the course of one year is recorded as being of well over fifty million net tons register. As an example of the accommodation available, it may be stated that at the Royal Albert and King George V Docks, situated at a distance of 40 miles from the seaward limit, vessels with a draught of 36 ft. can berth. In these two docks alone, quay accommodation is provided for ten miles of shipping. Such accommodation, although permitting of the handling of over twenty-five million tons of merchandise entering the port annually, of the colossal value of over seven hundred millions pounds sterling, has not proved of sufficient proportions, and recourse is constantly being made to extensions and improvements.

One very important improvement now being effected is related to the artificial lighting of this great dock area. The need for efficient artificial lighting in the dock area now controlled by the P.L.A. has manifested itself for considerably over a century; in fact, ever since the opening of the West India Dock in 1802, and the later opening of other docks, such as the East India Docks in 1806, St. Katherine in 1828, the Royal Victoria in 1855, Millwall in 1864, Royal Albert in 1880, and Tilbury in 1886—all privately owned before being merged into one homogeneous whole under the Port of London Authority in 1908.

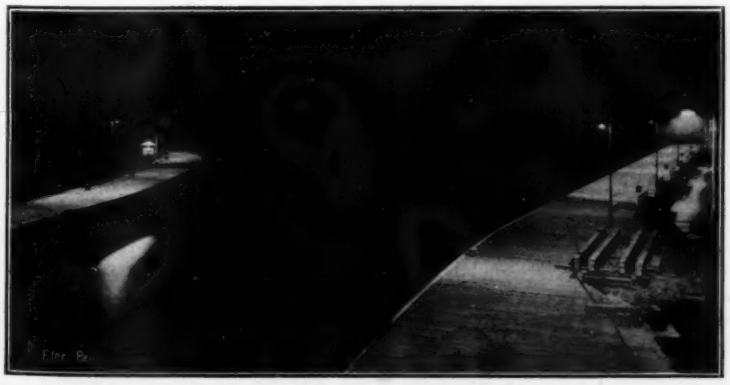


Fig. 1.—Entrance to Tilbury Docks by Night.

The system of lighting employed, whereby the normal activities of the day can be carried on throughout the night, is of revolutionary character, and is typical of the thorough manner in which the P.L.A. continues to interpret the trust reposed in it.

The actual lighting itself, so far as its application to the peculiar needs and requirements of navigation and dockside activities is concerned, constitutes a romance which, thanks to the foresight and study given to the subject by the Electrical Department of the P.L.A., is bound to impress itself indelibly on all those connected with, and catering for, the shipping industry by reason of the fact that it brings in its train a twenty-four hour day in which it is possible to embark or discharge cargo and passengers.

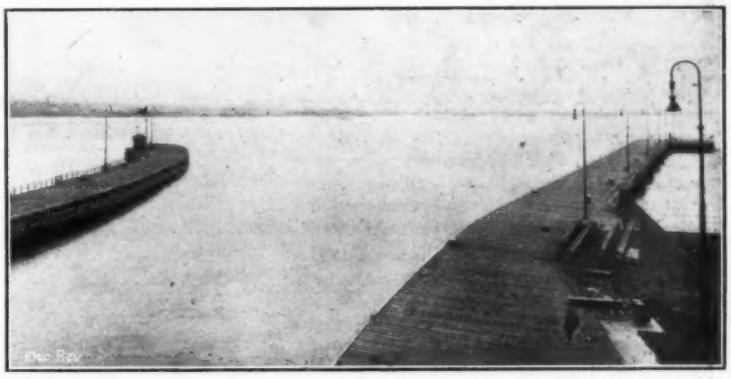


Fig. 2.—Entrance to Tilbury Docks by Day.

It is this revolutionary departure which redounds to the credit of the P.L.A. and the great shipping interests connected with the Port of London, as it permits, not only a great saving in time in the handling of vessels, but also of many "tides" being saved, and many weeks during a year being cut from idle "alongside" periods of vessels in seagoing condition. Further, the dangers of navigation in confined areas are considerably lessened by the system of dockside illumination which has now been adopted. As is shown by the accompanying "day and night" illustrations, the piers of the locks are faithfully revealed to navigators in the most clear-cut manner, as well as the interiors. It would be difficult to coin a phrase of greater intrinsic truth than that of "The Great White Waterways of the Port of London Authority," for indeed it provides an apt description of that which now exists at West India Docks, and also at Tilbury. It is safe to say that the system of dock lighting which is the product of the P.L.A. Electrical Department, acting in conjunction and in collaboration with the Illuminating Engineering Department of the General Electric Co., Ltd., is bound sooner or later to spread throughout the "seven seas."

The care and study given to this system of lighting prior to its adoption was of necessarily prolonged duration. It was governed by intense research and coupled with extensive tests entailing the preparation of characteristic curves and lighting diagrams to determine and satisfy the peculiar needs of a system of really efficient and dependable dock lighting which would function under conditions that were foreign in a

host of ways to those governing the usual form of transport lighting requirements, such as would be applicable to road and rail transport. As a result of these investi-

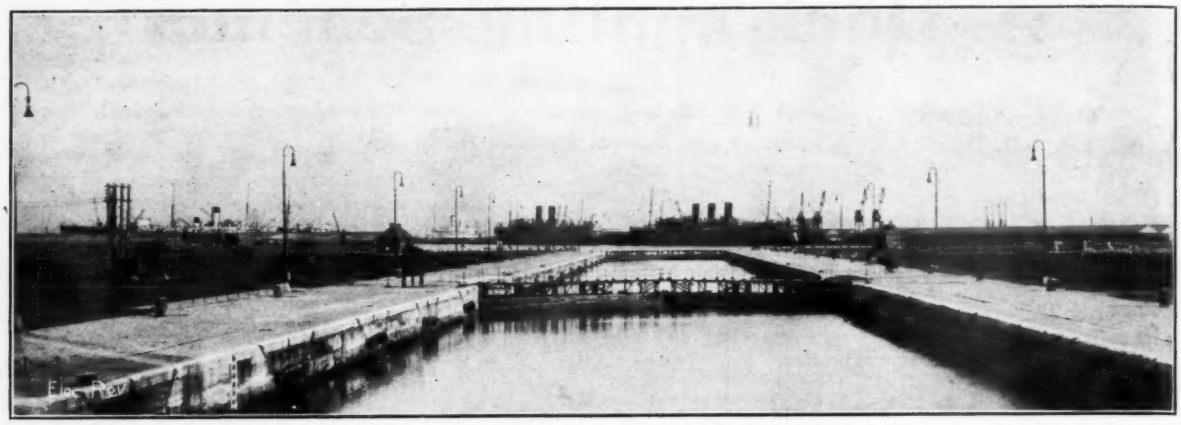


Fig. 3.—Day View of Lock at Tilbury Docks.

gations a type of lighting unit was specially developed by the General Electric Co. which incorporated certain well-known distribution characteristics that had been found successful in the lighting of important land thoroughfares, but with modifications that would render them suitable for the peculiar needs of dock lighting, and especially for enabling navigators to pick up the piers of lock entrances by night, and providing them with ample illumination of the locks and berthing at the dock sides. In this connection, and as a consequence, suitable lighting apparatus was evolved capable of providing the requisite distribution when operating at an approximate height of 30 ft., with a spacing of from 100 to 110 ft. The scheme has a distribution peak intensity at some 65 deg. to the vertical, with a cut-off closely approximating to the same angle. Incorporated in this lighting unit is a silvered-glass reflector of mathematically designed contour which permits of the above requirements being attained when using a 500-watt zig-zag filament lamp. The complete lighting fitting was designed by zonal flux methods to give a light distribution of such a character that with two fittings installed at the appropriate spacing, horizontal illumination values of uniform characteristics would as nearly as possible be produced. The initial tests proved of considerable interest, as it was found that by positioning the light source at a predetermined point in relation to the bottom edge of the reflector, an angle of cut-off of 71 deg. could be obtained, with a 65 deg. angle of peak intensity. In these tests it was found that owing to the limited size of the lamp filament used it was impossible to obtain an abrupt cut-off at the point of maximum intensity, and that therefore in its application to dock lighting it might prove preferable to compromise by adopting slightly different angles. Experiments were made, but the reduction in maximum intensity occasioned by altering the housing in relation to the light source involved a loss of intensity which precluded the results of such experiments being usefully adopted as part of the design of the unit. The type of lantern therefore adopted took the shape and character of that shown in fig. 4. In these units the body is constructed throughout of heavy-gauge copper, with a malleable-iron bridge piece, substantial steel strengthening straps, a single-piece "GECo-RAY" silvered-glass interior reflector, and a porcelain lampholder; the unit is equipped with a 500-watt zig-zag filament gasfilled lamp. Throughout its construction the fitting embodies those elements of strength and robustness so essential for lanterns installed in exposed positions. The patented ventilated top is an important feature, and one which has proved successful in operation under long and sustained conditions of rough usage, and in all climatic conditions.

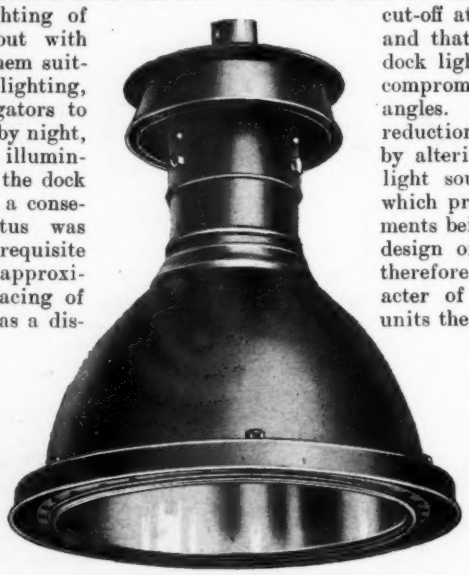


Fig. 4.—G.E.C. Dock-lighting Lantern.

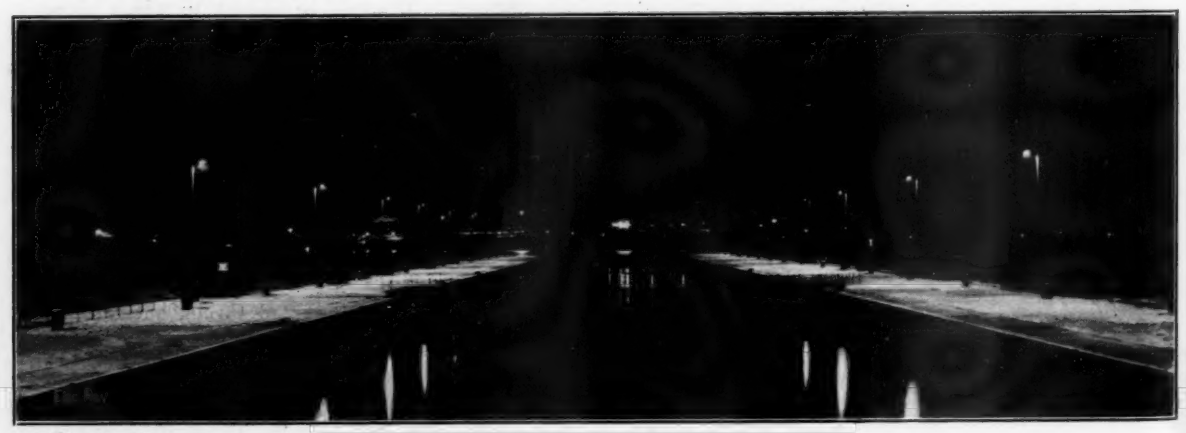


Fig. 5.—Night View of Lock at Tilbury Docks.

(To be concluded.)

Paris Agricultural Show.

Notes on Exhibits of Electrical Interest; a Special Type of Multi-purpose Motor Improvements in Plough Design.

By R. BORLASE MATTHEWS, Wh.Ex., A.M.Inst.C.E., M.I.E.E., F.R.Ae.S.

(*Concluded from page* 631.)

AMONG the larger motors the only self-contained gear-reduction type was the Law, which is very similar to the motor made in England by Ransomes, Sims & Jefferies. A number of portable motors were shown somewhat similar to that illustrated last week, fig. 4, *i.e.*, with self-contained counter-shaft and belting. In two cases ball-bearing countershafts were mounted on the motor frame itself; this makes a very neat arrangement. The reduction in speed for a farm machine drive is too much to permit of the use of a single belt, hence the necessary complication of a counter-shaft.

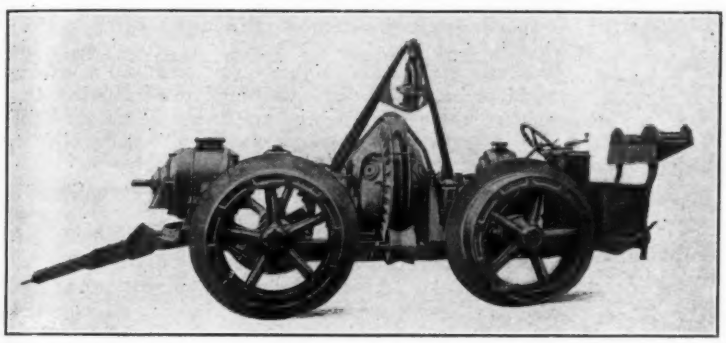


Fig. 6.—The Estrade 40-h.p. Electric Plough.

A number of automatic pumps were on view as in previous years, for the supply of water on farms at high pressure, which facilitates the quick filling of buckets, &c. The capacity is about 100 to 250 gallons per hour, and they are fitted with $\frac{1}{8}$- to $\frac{1}{4}$-h.p. motors. The storage tanks are of about 30 gallons capacity. Most of these pumps were again fitted with the "EMA" automatic controller.

Myers and other pump makers showed motor-driven attachments for temporarily or permanently converting ordinary hand pumps for electric driving—a matter of importance, for at 6d. per hour, over £6 per annum can be saved in wages for water pumping on an ordinary farm. The Myers line of larger pumps (some of which had glass valves and seats) incorporated a jockey pulley for belt tightening. The jockey pulley, in conjunction with short drives, seems to be very much more popular on the Continent than in this country. On a small pulley it certainly gives a very good overlap; also the belt adjusts itself for the extreme changes of temperature to be found on farms and, incidentally, this means saving the trouble of throwing off a belt when the machine it drives is finished with.

Several batteries of Tudor accumulators were on view. These were fitted with slotted wood, instead of glass, separating rods. Plywood sheets of wood are passed through these slots, thus one of the difficulties of the contact of buckling plates is easily overcome.

The majority of electrically-operated cream separators was belt driven by separate motors. The "Antilope" was, however, an exception, with its built-in vertical motor.

Among electric ploughs, the greatest advance was shown by the Estrade machine (fig. 6). After being in successful use for some years, its manufacture has been taken over by Als-Thom (a combination of a well-known firm of Alsacian mechanical engineers and the Thomson-Houston Co.) which has completely re-engineered it. This appears now to be a most reliable piece of mechanism. The writer had the opportunity of seeing the work accomplished by one of these ploughs some fifty miles north of Paris, and found that it had performed most creditably, to the utmost satisfaction of the farmer upon whose land it was operating. The electrical equipment was of the robust nature associated with tramway work, and, though only weighing some five tons, it will carry out the work of a 15-ton plough. This is due to its peculiar construction, whereby the pull of the rope is directed through a hydraulically-supported swinging arm on to the ground. Fig. 6 illustrates the new design. The swinging arm can be seen in the centre. The 40-h.p. motor on the left is so wound as to provide two speeds. The ball-bearing-mounted speed reduction gear (see fig. 7) is mounted in a casing under the swinging arm. A 10-h.p. motor is employed for moving the plough. The saddle at the rear is provided for carrying the 20 mm.² three-core, 400-volt, unearthed, tough-rubber-sheathed cable.

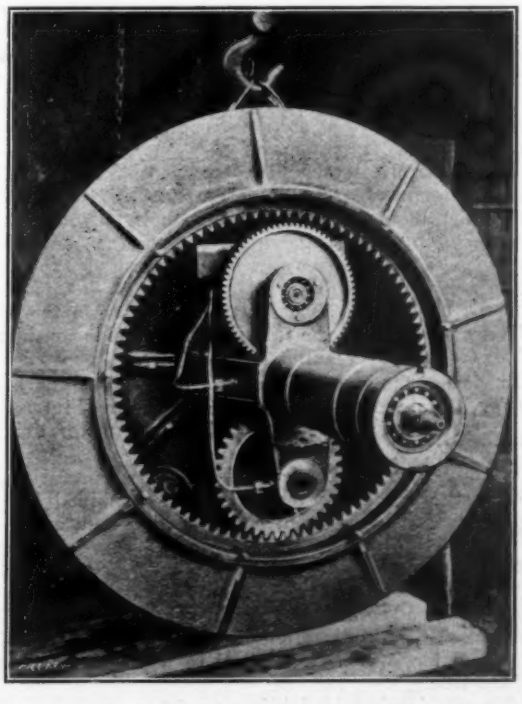


Fig. 7.—Speed-reduction Gear for Estrade Plough.

In connection with the general practice of electric ploughing in the neighbourhood of Paris, the writer again made inquiries from the subsidiary company that operates electric ploughs for the various companies, and from one of the directors of one of the important electricity supply companies, who is also on the board of the ploughing company. Financially, the ploughing company is only just covering its expenses, but this it attributes to the breakdown of ploughs, which it hopes to remedy by improved designs, it being of the utmost importance that an electric plough should work right through the season without accident. Incidentally, however, the electricity supply companies benefited by the large amount of current sold. In 1919, 1,000 acres were ploughed electrically by such sets; in 1929 the acreage was 20,000.

The electric ploughs now in operation in the neighbourhood of Paris are distributed as follows:—

No.	Make.	Area.
1	S.G.A.	Nord Lumière.
1	,,	Nord-Est Parisien.
1	,,	Ouest Lumière.
4	Guedeney	Nord Lumière.
1	,,	Department de Eure and Loir.
2	Estrade	Cie. Electrique du Nord.
1	,,	Energie Industrielle
1	S.G.A.	Co-operative Society de Vexin.
2	,,	Co-operative Society de Multien.
14		

There were two small market garden electric ploughs on view, one of 5 h.p. constructed by S.G.A., and the other, a new 2-h.p. machine, the "Rigondeau," made by Roger Vignaud.

A new 2-cwt. sack hoist, the "Demag," was of extraordinarily neat and compact design, the whole unit being comprised within dimensions of less than one foot each way. The price was about £22. This is high compared with the more bulky electrically-driven plate-metal constructed sack hoist, which sells at about £15. For hay-hoisting, the Lambert-Rivière Company showed a very neat totally-enclosed worm-reduction hoist gear, which was complete with brakes and controls for operating the Temperley method of lifting and traversing. This is carried out by large automatic grip fork-loads or complete cart-loads. The latter is, of course, the preferable way, as it so expedites work at busy times.

A remarkable development has been made in the transport of hay, straw, chaff, and grain by means of fans which blow the material through light galvanised sheet-metal tubes. While in some cases the stuff has first to pass through the fan itself—in which type the blades are mounted on a side runner—in the latest patterns chutes are formed, which feed into the air delivery piping near the fan discharge. This considerably reduces the breaking of the straw.

In view of the increased demand for egg grading and testing, two new machines for this work were of interest; of course electric test lamps and electric motor drives were employed.

On any farm a circular saw is a most useful tool. The bascule or tilting table type of combined bench top and swinging cross-cut log holder has been growing in popularity for many years, and nowadays a most satisfactory and cheap tool, constructed of angle iron, can be obtained. Small log and firewood sawing is certainly made much safer by this method. The tension of the belt is often maintained by the weight of the motor, which is attached to a platform hinged at one side.

A portable electric drilling machine was shown by several makers very ingeniously adapted as a lathe. The driller was held in a clamp that also supported a turned bar, which served as a lathe-bed. On this bed a tailstock, tool support, circular saw bench, &c., were attached. The r.p.m. was 550, and hence the combined machine is really only suitable for wood-working.

As usual, a large number of washing machines were on show. While the finish is not of a high standard, the prices are extraordinarily low. The larger size, suitable for 40 shirts, or eight to ten sheets, or 28 lb. of dry linen, sells at under £4, plus another £5 for an electric motor. It would seem to be well worth while introducing this type to the British market, for though the electricity consumption is small, it is an excellent advertiser of the advantages of electricity; in fact, the South Wales Power Company employs it to persuade the farmer, through his wife's appreciation of the washer, to install electric driving for his barn machinery. Further, the electric iron—a big current consumer—always follows the washer.

This agricultural machinery exhibition was the ninth to be held in Paris without the counter-attraction of any live stock. On this occasion the enterprising director, Mr. A. Villard, produced in five languages an even more improved catalogue than the very excellent one of the previous year. Again the show was noteworthy for the very large number of electric motors in use for the demonstration of farm equipment of all kinds.

The strict classification of exhibits according to their kind is most useful to the buyer. It is also more impressive; it is a fine sight to see over 150 threshing machines in serried ranks on 87 adjacent stands. One wonders where all this big variety can be used. Still, year after year, they are shown, so that the exhibitors must reap some reward.

France is one of those countries where agriculture is fostered as a national asset; hence there is a good business in agricultural machinery sales (not forgetting the necessary electric motors to drive them).

This article is not merely a description of an exhibition, for much more lies behind it. It is rather a record of electrical progress in the world's greatest industry—in a field where there is an enormous future for central electricity supply service.

Irradiation and Plants.

An inquiry into the effects of selective solar irradiation on the germination of seeds, growth of plants, and development of chlorophyll, is described in *Science*. The investigation was undertaken for the purpose of discovering whether the energy in the whole range from infra-red to ultra-violet was equally necessary for germination, development, growth, and maintenance of existence, or whether quality (wave-length) and quantity (intensity) of energy entered as important factors; whether certain wave-lengths and intensities of radiant energy were used by plants for one purpose, while other regions and intensities of energy performed a different service; whether certain wave-lengths of solar radiation promoted growth, while other regions of solar energy retarded it; whether the development of chlorophyll was chiefly dependent on the infra-red, visible, or ultra-violet rays.

Tests made included the physical measurement of the quality (wave-length) and quantity (intensity) of the radiant energy used, the amounts of chlorophyll developed, and so forth, and by conducting biological experiments on the number of germinations, heights and weights of plants, and areas of leaves.

The investigators came to the following general conclusions:—

(1) The ultra-violet and infra-red portions of sunlight are stimulating to germination and enhance growth and development.

(2) The green portion of the solar spectrum, which is its region of maximum energy, is inhibitory to the processes of germination and growth.

(3) The development of chlorophyll is enhanced under the yellowish-green, green and greenish-blue regions of the spectrum.

(4) The least development of chlorophyll occurs under the ultra-violet and infra-red portions of the spectrum.

Electric Cable Jointing.

The author discusses the weakest points in medium-pressure jointing, and methods of overcoming them; the resistance of joints and strand to strand contact in cables; the most suitable type of soldering flux, and the main details of plumbing; dimensions of suggested standard joints; and the training of jointers.

By LAURENCE A. GRIPPER, A.M.I.E.E.

(*Concluded from page* 629.)

Plumbing.—To ascertain the standard of plumbing attained, a number of joints were cut out immediately after they had been plumbed, and before they were filled with compound. The jointer then having capped the cable ends and plumbed up the compound filling

Fig. 14.—Well-designed Filling Hole.

holes, a small pipe connected to a hydraulic pump was plumbed into the sleeve, and the sleeve subjected to a water pressure of 100 lb. per sq. in.

These tests showed that while plumbing was good at the end of sleeves, there was a decided weakness in seams, filling holes, and cable end caps. Upon further investigation the author formed the opinion that this more or less general weakness could be explained in the following manner. When plumbing a straight joint at the ends of the sleeve, the first thing to do is to tin the cable, and, although the sleeve itself is usually tinned before it is beaten down, a certain amount of retinning must be done. The proper tinning of the cable and sleeve is one of the secrets of successful plumbing, and requires much practice. It can be accomplished only if the hand which holds the cloth is kept constantly moving whilst the metal is being spilt on to the sleeve and cable from the ladle; nevertheless, although it requires knack, it can be carried out properly by any good plumber-jointer. The plumbing of a seam or compound filling hole is, however, a different matter; first, because there is only a comparatively small amount of metal used, and, secondly, a blow lamp has to be used, and as a result the wiping or tinning action previously mentioned is not obtained. The usual method of plumbing a seam, for instance, is to spill the plumber's metal from the ladle on to the seam along its length and then with the aid of a blow lamp finish the seam off neatly by gradually moving it along the sleeve. Under these conditions it is very easy to miss tinning some small portion of the sleeve, with the result that pinholes are likely to occur, and, further, owing to seams usually

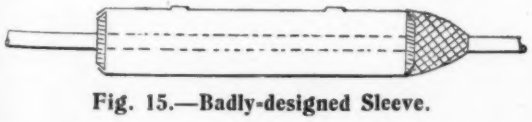


Fig. 15.—Badly-designed Sleeve.

being at the top of the sleeves, the pinholes do not show up in the same way that they would in the end plumb when a sleeve is filled with compound.

For this reason, therefore, the writer advocates having the seam of a split sleeve arranged at an angle of 45 deg. to the vertical, so offering the compound an opportunity of leaking out if the seam is faulty and so giving the jointer an opportunity of re-plumbing it. An additional advantage which this arrangement gives is that it lessens the chance of metal dropping through the seam when it is being plumbed on to the joint, as the tendency will be for it to run round the inside of the sleeve and quickly cool, rather than drop direct on to the joint.

Filling holes should be arranged with a screw-in brass plug (fig. 14), or, in the case of small joints, two slits can be cut in the sleeve, one at either end; when the sleeve has been filled with compound, these can be carefully sealed up by gentle tapping with a small hammer and run over with a stick of solder. Cable ends also require careful plumbing, and the plumb can always be tested by warming up the cable slightly, after the cap has been finished off, to see whether any oil leaks out.

In connection with plumbing, it is well to remember that the design of sleeves which call for large plumbs is very important. Fig. 15 shows a badly designed sleeve, insomuch that the ends of the sleeve are arranged in such a way that it is difficult for the jointer to tin the cable and end piece properly, as he cannot easily fit his cloth against the end of the sleeve. Fig. 16 shows a well-designed sleeve from the plumber's point of view,

Fig. 16.—Well-designed Sleeve.

as, first, he can easily tin every part without having too much metal in his cloth, and, secondly, he has to use much less metal than in the former case, which results in a much more comfortable and satisfactory plumb.

As both plumbing metal and lead sleeving are expensive items, the author has developed a set of standard measurements which he advocates for various types of joints for 0.1 and 0.15 sq. in. conductors. These, together with the weight of sleeves and plumbing metal required, are illustrated in figs. 17, 18, and 19.

Compound Filling.—Whilst the author does not propose to go into the question of the actual compound to be used for various types of joints, there are one or two points which he considers of great importance. In connection with non-plumbed joints, where the compound is relied upon as a seal, it is essential that (1) a reasonable length of cable lead should be inside the box for the compound to adhere to, and (2) this lead should be scraped clean as carefully as if a plumbed joint was being made before fitting the box into position.

The writer has found over and over again in his examination of this type of joint that practically no cable lead sheath was brought into the box, generally because (1) the box and fittings were designed in such a way that there was not sufficient room for the cable

lead sheath to be brought far in, and (2) the importance of bringing the cable lead sheath well into the box was not appreciated.

Further, it is customary after the armour has been taken off a cable to wipe the lead sheath clean with paraffin, with the result that an oily film is left on the cable lead, thus preventing proper adhesion of the compound. The writer suggests that, when cast-iron boxes

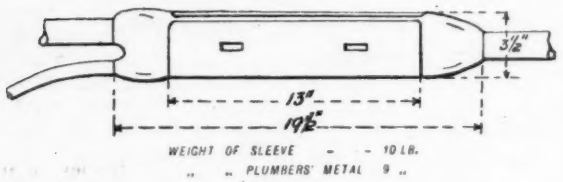


Fig. 17.—" Y " Service Joint; 3- or 4-core.

are used instead of plumbed lead sleeves or boxes, they should be arranged so that there is at least one and a quarter inches of lead inside the box on each cable, and also that it is just as important that this lead should be scraped clean as it would be if a plumbed joint were being made.

There is one further point of importance in connection with compound. It is often the practice to fill the outer cast-iron boxes or troughs of a plumbed joint with bitumen, and in some cases the box is not even filled at all. Owing to the fact that, however carefully plumbing is carried out, there is always the possibility of a pinhole, the author considers it advisable to fill this outer box with a solid compound, this being especially important if the sleeve is filled with a semi or fluid compound. Bitumen has not the characteristic of adhering to the cast-iron box or lead sleeve in the same way as compound does, and hence does not seal a possibly faulty plumb properly.

Standard Joints.—Before considering the actual methods to be employed for the training of jointers, the author proposes to deal with the subject from a general point of view. It is necessary for an undertaking not only to have an organisation whereby jointers can be properly trained, but also one that gives facilities for jointers to learn the main principles aimed at in a newly-designed article. It is quite possible to redesign some article with a definite object in view, but, unless this object is fully understood by the men concerned, probably no advantage is gained.

To enable jointers to keep in touch with any alteration in design and to set up a standard to which jointers must be trained, the writer is a strong advocate of having a set of " standard joints." These joints can be arranged in various stages of their con-

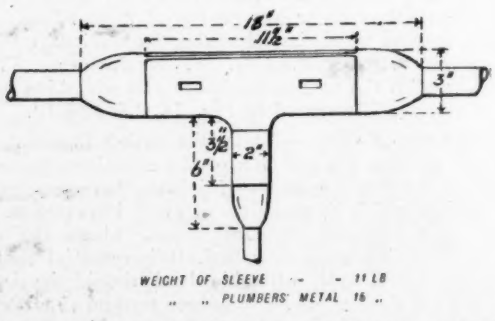


Fig. 18.—" T " Joint; Triple Concentric; 3- or 4-core.

struction with a card beneath them giving full particulars of the main points to be noted when making the joint. The joints should be mounted in a cupboard, and should be available to every jointer, so that measurements can be taken at any time.

If this scheme is put into operation, work gradually becomes standardised on the correct lines, and any new type of joint which may be devised for a special purpose can, after it has proved its worth, be added to the collection. Further, not only is workmanship improved by working on well-defined principles, but the jointer himself is also more satisfied in knowing that these exist.

Training of Jointers.—The training of jointers is often a difficult problem which is accentuated by the fact that the " apprentice " seems to have almost disappeared from the jointing world.

The writer considers that the most suitable type of man for making into a jointer is one who has had several years' electrical or mechanical training. Before he is taught any jointing he should have served several years as a mate to a good plumber-jointer who is preferably employed on various classes of work. During this period he will gain experience of jointing, and the likelihood of his making a successful jointer can be considered.

The final and concentrated training of such a man should extend over a period of at least three weeks. As plumbing is perhaps one of the most difficult things for him to learn, he should commence by making two plumbs per day. At first plumbing should be carried out indoors at a comfortable height from the ground, but gradually conditions should be changed to those which exist in practice. The most important plumb to master is the end plumb, and once this can be made satisfactorily, the learner will very soon adapt himself to other types of work.

As live jointing is predominant to-day for service work, it is important that this should be properly

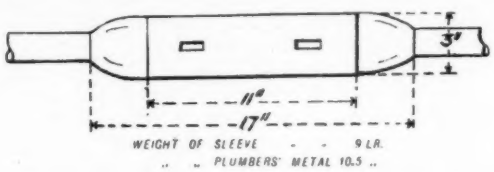


Fig. 19.—Straight Joint; Triple Concentric; 3- or 4-core.

carried out. A simple arrangement for teaching live jointing is to feed a short length of cable through a light fuse with a recording voltmeter connected across the cores at the far end. A service joint can be made, the cable can be cut and temporarily bridged, or a network box can be made up and jointed just as it would be in practice, the recording voltmeter giving a record of any variation in voltage. During the period of training the learner should make a sample of each of the standard joints, and his work should be checked over and discussed stage by stage; further, he should be made to dissect any old joints available so that the workmanship therein could be criticised. During his training his methods of boiling tapes, heating compound, and the various other details connected with jointing should be thoroughly discussed, and every encouragement should be given him to ask questions, and also to carry out small experiments in jointing, as this will probably be the only time that he will have such an opportunity.

When the end of the training period arrives and the learner is considered to be fit for jointing work, he should at first be put to simple work, allowed to work slowly, and carefully watched with a view to teaching him how to organise his work and men properly. If he prove reliable he can then be gradually transferred to higher class work, his joints being unexpectedly cut out occasionally to test his workmanship.

The author is of opinion that, if these methods were universally adopted in conjunction with the collection of standard joints previously mentioned, a much higher class of workmanship would result, which would not only benefit the undertaking concerned, but would also result in a pride being taken by jointers in good workmanship.

The Prince Edward Theatre.

Brief Accounts of the Electrical Equipment and a Novel Switchboard.

THE new Prince Edward Theatre, which was opened on April 3rd, occupies a site on the old Compton Street-Greek Street corner in Soho, W.

At night time the theatre is flood-lighted from the exterior canopy and cornice, and night signs, carrying 18-in. and 12-in. letters, display the title of the production and the names of the principal artistes.

The entrance is from Old Compton Street, through a circular walnut-lined hall, fig. 1, lighted from around the ceiling dome on the "Leylite" concealed system, which is adopted throughout.

The electrical installation, some illustrations of which are given in figs. 2, 4, 5, and 6, was carried out in its entirety by the Berkeley Engineering Co., Ltd., which designed all the fittings, excluding the glass work.

Fig. 1.—The Main Entrance Hall.

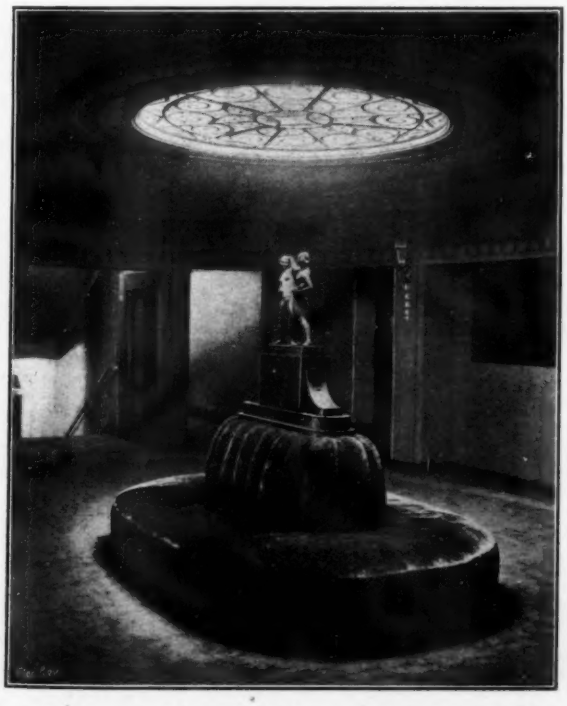


Fig. 2.—An Example of the "Leylite" System.

All the wiring is run in screwed steel tubing, and Henley v.i.r. wire is used throughout. Approximately 52,000 yards of various sizes has been used, mains above 0.1 sq. in. being paper insulated, lead covered, while special asbestos-covered cables, to comply with the L.C.C. Regulations, are used for the switch and dimmer boards. Another special cable used in the lighting scheme is a Henley multicore cable, which is employed on the pilot batten lights above the stage, instead of several cables in canvas hose.

Supply is taken from the Charing Cross Supply Co.'s ordinary network, the total connected load for the stage being 160 kW. The total load for the auditorium, which has a seating accommodation for 1,650 persons, is 32 kW, and for the saloons, foyers, passages, staircases, &c., 40 kilowatts; the signs absorb a further 50 kilowatts.

The equipment of the stage consists of five ordinary battens; an "effects" batten; one horizontal lighting batten; nine 4-colour dips on the stage floor; four 4-colour dips in the flies; and the same number on the bridge and grid. There are two arc dips on the stage and two on the bridge.

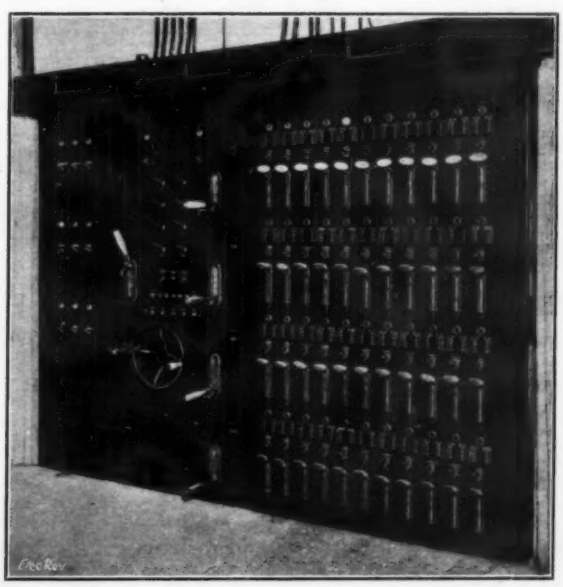


Fig. 3.—The Pre-selective Switchboard.

An outstanding feature of the installation is the pre-selective type of switchboard (fig. 3), designed and manufactured in its entirety by the Berkeley Engineering Co.;

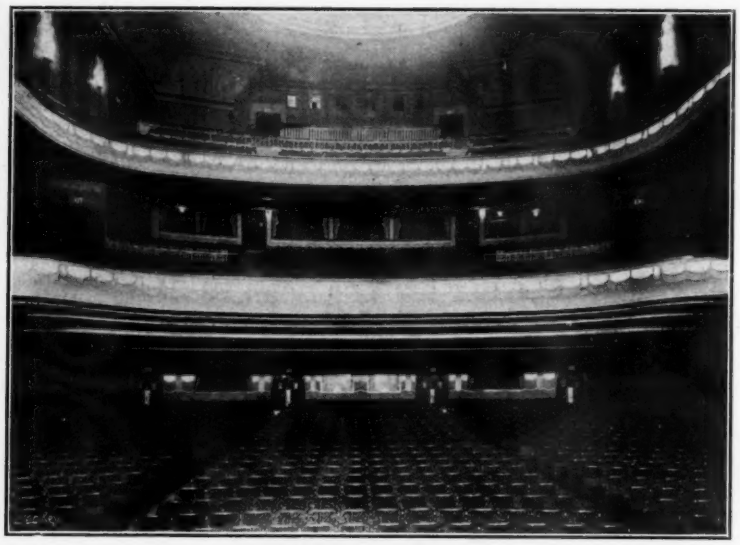


Fig. 4.—Auditorium Lighting Scheme.

it allows the lighting for eight scenes to be preset, requiring the operation of only one switch to light any complete scene. Incorporated in its construction is a special selective board which deals with the "all-effects" batten, while the main board can be worked as an ordinary hand circuit. There is a switch for every lighting circuit and a switch for every colour lighting scheme. Colour masters and their combinations are plainly marked on the board, all the engraving of which—letters and numerals—was carried out by the electrical contractors. A novel arrangement of slot closers has been adopted, crescent-shaped pieces of brass being ingeniously fitted to overlap one another, thus preventing the ingress of dust and dirt to the main switches. Every colour combination likely to be required by the producer can be set or preset by a few switches. The system of cross-colour and the locking arrangements are elaborate, although simple in operation. The board control is practically fool-proof. Batten pilots may be operated independently or thrown into the dimmer circuit. The board is remote-controlled and remote-operated, and the main stage lighting effects and dimmer control can be dealt with by the same board. It is itself lighted, so that while a dark scene is being played the numerous switches and their labels are easily discernible by the switchboard attendant.

A complete system of telephone communication is in operation throughout the building, buzzers and light signals being used in preference to bells in the precincts of the stage.

An operator's box is provided to enable the theatre to be adapted to trade shows of silent and sound films.

All the fittings for the auditorium lighting were designed in accordance with the general decorative scheme, and are installed flush with the surface.

All the ordinary distribution fuse boards are of the ironclad type, and the whole of the fuses for the stage and auditorium equipment are of the "Desco" self-aligning pattern. Main circuit breakers are employed, and earth leakage indicators are provided wherever the current exceeds 100 amperes in any one circuit.

The ventilating plant is "Plenum," and the air-cleansing plant is by the Carrier Engineering Co.; this is automatically regulated by the temperature of the air, which remains constant, whether the theatre is full or otherwise.

Fig. 5.—The Lighting above the Proscenium.

It is understood that, so far as theatre equipment is concerned, this is a new method, albeit only one of the many novel features incorporated in the electrical installation of this theatre, which was designed by Mr. Edward A. Stone, F.S.I., and the consultant is Major Charles H. Bell, O.B.E. The photographs illustrating this article are reproduced by permission of Messrs. W. T. Henley's Telegraph Works, Ltd., and of the *Architect and Building News*.

Fig. 6.—Restaurant Illumination.

Electricity for the Home.

The Small Electric Fire.

By G. E. MOORE.

RECENT years have witnessed a growing attack from the "heavies" represented by the electric vacuum cleaner, refrigerator, water heater, and the somewhat lumbering cooker. During this time there has been an unobtrusive and surprisingly wide consolidation of the small electric fire, a little apparatus which, for many reasons, is of considerable significance in the electrical field. Perhaps the cheapness of the individual fire somewhat damps the zeal of publicity managers and salesmen. In districts which have been over-run by rival vacuum-cleaner agents (who are being classed with sewing-machine salesmen) no one appears to champion the small fry of electrical appliances. On the other hand, the small electric fire (which we may take as being up to 1 kW in size) represents a consuming agent of greater possibilities than many expensive appliances.

The small electric fire appears in several guises. Its most familiar one is the so-called bowl radiator—a truly ubiquitous fire which one sees in all manner of domestic services, in offices, workshops, garages, and the like; the 600-watt size is popular, and the tilting arrangement adds to its appeal. There seems to be an inclination to use it under unsatisfactory conditions. One of the latest types is claimed to perform its duty by direct heating, by reflection, and by assisted convection.

In another ingenious form a dual purpose is served by the outfit: the heating element acts either as an electric fire or as the series resistance of an embodied arc-lamp for ultra-violet-ray emission; whilst in use for artificial-sunlight treatment the warming rays of the resistance may by no means be unwelcome! Another interesting fire of about ¼ kW only can be readily adapted for water-boiling and like purposes. Whether apparatus of specifically adaptable qualities is really appreciated or desired is debatable; for one reason or another, in both technical and public circles, appliances with multi-applications are not always justified or favoured.

The bowl fire is often used where that other form—the radiator with flat or curved fire-bars—would be preferable; the latter radiator, usually rated somewhat higher than the bowl type, is more suited to semi-permanent positions and the domestic amenities; moreover, the amount of heat emitted is probably, in a general sense, more acceptable. One must not neglect to mention the semi-enclosed fires for such purposes as bathroom and drying-cupboard heating, or the kindred heating units made in jacketted form.

These small portable electric fires have many uses and advantages. In first cost they are not dear, and in use their consumption is not great; they are easily carried, readily connected and rapidly effective—points which are certainly appealing and of which more might be made. Their true function is perhaps for occasional heating, and in this connection they serve their purpose in all manner of places and times, from giving a helpful glow on chilly mornings to a supper accompaniment after a theatre or dance. They are called upon at all seasons. Sometimes they assist the rival coal fire when the latter is getting under way, and later, too, when the embers are low and the scuttle empty. Though the warmth afforded by them may sometimes seem ludicrous, there is certainly a mental as well as a physical appeal. The glow, too, is often invaluable as a dim light. They are also pressed into other occasional services: by the housewife for toast making, butter softening, bed warming, clothes drying; by the nurse at the summons in the small hours, and for the patient sitting up; by the laboratory worker for drying-out purposes, especially statical experiments; at the toilette, the drying of hands and hair are practiced; frosty weather finds small radiators on the defensive near tanks and pipes; and so on. Prolonged service, on the other hand, is also demanded—and given. In small rooms, tobacco kiosks, offices, and the like, the small electric fire is efficient and accordant, while, sitting at one's bureau, it affords just that gentle local warmth which keeps one at business.

Though one can be genuinely enthusiastic over the portable electric fire, there are, however, aspects which are not favourable. For instance, its very convenience results in harmful usage. One application—having latent danger for the user and peculiar difficulties for the electrical industry—is in bathroom heating; it happens that many modern bathrooms are of the size which *can* be warmed by a small radiator; no doubt the inhibiting effects of accidents upon the public, and a more rationalistic and co-ordinated effort as regards safety-first fittings, will avert the menace.

And here one cannot forbear mentioning the provision in so many cases of adaptor connectors. It is obvious that the majority of households have no other means for connection than by the pendant lampholder—usually a comparatively flimsy affair; it is equally obvious that often the current which flows through the lampholder connection is more than is permissible. Yet there is no doubt that the adaptor connector has been an important selling point. It must be admitted that for a table utensil the lampholder so conveniently to hand is the natural source of energy, but a floor appliance is in a very different category. Earthing, under existing conditions, seems almost a more remote ideal than the provision of plug outlets in each room of every house. Fortunately, except by an unusual combination of adverse circumstances, a harmful shock seems rare.

The popularity of the bowl fire has brought many remarkably cheap designs upon the market; though it is a fairly robust appliance, there is a danger of gimcrack fires making their way into many homes. Bases could, with advantage, be heavier. There is also too common a reliance upon light twin flexibles—possibly induced by cheapness and the adaptor fitting. The small fire, which is so portable and so useful in all manner of places, is liable to be placed where furniture or the like can unwittingly be spoiled, the *heavier* radiator, as a rule, being put down in the safe place sacred to fires.

Moreover, the small fire is often used under farcical conditions; for example, a prolonged run in a vain endeavour to warm a large room. But this can be used as an argument in favour of complete abolition of all methods of heat derivation from localised sources—methods which convention and the building industry still sedulously encourage, but which (let us hope by electrical means) will one day be a thing of the past, with benefits in the shape of greater floor space, simpler and cheaper building construction, and general comfort.

Nevertheless, the small electric fire is a welcome development. To the manufacturer it is an appliance with almost a universal appeal. To the supply undertaking it is of far greater and lasting significance: its loading is moderate and its load factor is good—for it is used at all hours during the year, and as often as not at non-peak times. Furthermore, it is an appliance which is bought outright, which is regarded as a welcome present, and which inevitably makes its way into innumerable homes. Because of all this and its appeal to a creature comfort in this dubious clime of ours, the ubiquitous little fire is a leading propagandist.

Reviews.

"Starkstromtechnik." By E. v. Rzcha and J. Seidener. Pp. xix+1,039; illustrated. Berlin: W. Ernst und Sohn. Price: cloth, 34 marks; leather, 37 marks.

The comprehensive nature of this work makes it impossible to deal in reasonable detail with all the sections within the space allowable for standard reviews. The work is intended to embrace the whole range of electric power engineering. The first volume contains sections dealing with Mathematics, the Physical Fundamentals of Electro-technics, Measurements, Electrical Machinery and Transformers, Rectifiers, Accumulators, Switch and Control Gear, Installation Materials, Illumination and Thermo-electricity.

The mathematical section gives what, in the reviewer's opinion, is an excellent summary of the differential and integral calculus, nomography, series, harmonic analysis, differential equations, and vector analysis. It is particularly interesting to note that partial differential equations, the elements of the mathematics of rotations, surface gradients, and surface divergencies are included. These subjects are, in general, treated only in the highest standard of Technical Institutes, and it is somewhat surprising to find them dealt with as though they should be part of the working equipment of the average electrical engineer.

The succeeding sections proceed logically from pure electro physics to the various branches of power engineering.

A pleasant, and in the reviewer's experience, an unusual feature of the power engineering sections is that they actually utilise the fundamental principles laid down at the start of the book. The amount of space and the degree of detail in which the subjects are treated are in close accordance with their actual commercial importance.

As is inevitable with comprehensive works, it has proved impossible to include intimate details, or even to indicate some of the most important aspects of the subjects; *e.g.*, in the section dealing with accumulators, less than one page is devoted to the method of operation and construction of the alkaline accumulator.

The descriptions of switching apparatus occupy twenty-one pages, and it is interesting to note that armour-clad switchgear is at length receiving some measure of attention in Germany. It is further pleasing to find that the pioneer work of Messrs. Reyrolle is handsomely recognised.

It will not be possible to offer a final criticism of this work until the second volume becomes available. Apart from feeling that the amount of material included is too heterogeneous, the first volume can safely be recommended to anyone who is interested in the study of heavy electrical engineering from a fundamental standpoint and who wishes to have a sound base always at hand.

C.W.M.

Trade Marks Simplified. By Herbert J. W. Wildbore. Pp. 113. London: Jeffcoats, Ltd. Price 10s. 6d. net.

This little book, which has apparently been produced with a view to advertisement as well as to assisting the commercial public, deserves fully the name which the author has conferred upon it. Every effort has been made to render the difficult subject of trade marks intelligible to the ordinary business man. A brief outline of the history of trade marks, a concise but adequate statement of the law relating to them, and, most useful of all, practical considerations of the matter of choice and procedure in registering a trade mark, are all included within the space of a hundred pages or so.

The work should prove of great interest to-day, when trade marks are becoming more and more popular. The present intensity of competition in all trades makes it desirable for each merchant to safeguard his goodwill by designating his goods by some distinctive mark which will be protected by law for his exclusive use. Besides this, the numerous improvements in manufacture, and the wealth of invention displayed in the production of fresh articles of use and ornament renders it almost necessary for inventors to utilise what protection the law provides. A registered trade mark will often serve the same purpose as a patent. It may not prevent others from copying the invention or the mode of manufacture, but it will ensure that an established goodwill in an article of particular manufacture will be protected.

Although it is no doubt Mr. Wildbore's intention that all who are persuaded by his book to adopt a trade mark shall avail themselves of his services (since he is a professional expert in the subject, and practices in the city as a patent agent) his book will, if carefully read by the intelligent layman, be sufficient guide to those who prefer to do things for themselves. His chapters on the method of registration and choosing a trade mark, and the very full description of the divisions of the trade marks register, provide ample assistance to the merchant who wishes to do his own registration.

Indeed, it seems that this book has been compiled entirely for those contemplating registration. Traders who already have trade marks will not find a great deal of assistance from the book. There are some very useful notes on the assignment of trade marks, and the consent and acquiescence of owners to the infringement of their marks. But the very vexed question of what exactly will constitute an infringement in any given set of circumstances is not dealt with. Indeed, it is difficult to see how this could have been done outside a heavy legal treatise. Traders who are contemplating taking action for infringement, or who are desirous of finding out how far they can go without involving themselves in an action for infringement, are not the persons for whom this work has been compiled. But for those traders who are bringing out new lines, or who are desirous of safeguarding their interest in old ones, and wish to utilise the protection of the trade marks law, this book will be exceedingly instructive and useful.

Commercial A.C. Measurements. By G. W. Stubbings. Pp. xvi+325; figs. 169. London: Chapman & Hall, Ltd. Price, 15s. net.

In this book, which is concerned with the theory and practice of the measurement of current, voltage, power, energy and power factor in a.c. circuits, the author has rendered a very considerable service to the profession in addition to enhancing his own reputation as an authority on electrical engineering technology. The subject of a.c. measurements is one which is peculiarly susceptible to the mode of treatment—it can be made incredibly dull and totally uninteresting, or it can be infused with a vigour which sustains the reader's interest to the end. The present volume does not permit our interest to flag for a moment, and it is a model of composition in its pithiness, accuracy, and freedom from annoying padding. In ten chapters and an appendix the book covers a summary of elementary a.c. theory in its bearing upon a.c. measurements, measurements in three-phase circuits, the measurement of current and voltage and of power, instrument transformers and their characteristics, the measurement of energy, of power factor, of reactive power and of kilovolt amperes, test room equipment and notes on the trigonometry of a.c. theory. In particular we commend the first two chapters and the appendix to the attention of electrical students, as forming an admirably conceived and prepared basis for the complete study of the theory and practice of a.c. measurements. The author's liberal use of vector diagrams to illustrate the subject meets with our warmest approval, and the volume might almost be regarded as a very useful introduction to that fascinating study. The mathematics introduced are of the simplest forms, being limited in most instances to commonly used trigonometrical expressions. The book is essentially a practical one and of the utmost value to testng engineers of all grades in the factory and on the inspection staff. We are glad to have the opportunity of bringing so valuable a treatise to the notice of the electrical profession, and we cordially recommend it as an indispensable addition to the engineer's private library. The price is most reasonable, and the expenditure upon a copy of the book may be regarded quite safely as a profit earning investment. We do not need to eulogise the publishers—they are Chapman and Hall, Ltd.

S. A. S.

Photoelectric Cells. By Dr. Norman Robert Campbell and Dorothy Ritchie. Pp. vii+209; figs. 41. London: Sir Isaac Pitman and Sons, Ltd. Price 15s. net.

The authors, both of whom are members of the research staff of the General Electric Co., Ltd., at Wembley, have provided a badly needed text-book on the subject of the vacuum and gas-filled cells and their mode of employment. They have succeeded in doing what they set out to do, according to the preface, *viz.*, to treat the photoelectric cell, not as an illustration of important laws and theories, but as a laboratory or workshop tool.

Photo-cells require skilful handling if they are to give accurate measurements of light intensity, and many points have to be taken into account, the guard ring, the shielding, careful control of the voltage applied in order to work just beneath the glow potential, and so on. With all such points the authors deal clearly and practically, and they have contrived to make their text admirably clear, thereby greatly extending the range of readers to whom the book will be of value.

Electrostatic methods are discussed in detail. These methods are of considerable value in absolute measurements with small currents. For more practical work valve amplification is almost indispensable owing to the very small amount of current given by even a gas-filled cell. One of the most useful circuits is probably the bridge amplifier discussed on page 140. The application of photo-cells to measurements of illumination, colour, absorption, and luminous flux are dealt with in a concluding part of the book, but in such subjects as colour matching, spectro-photometry, grading, photo-telegraphy, and sound films, the authors give rather a discursive survey than particulars of methods of working.

The briefness with which the all-absorbing subject of the talking picture is dismissed is to be regretted, as it is in this very region that authentic suggestions for suitable experimental circuits are so woefully lacking in the ordinary literature. The authors, indeed, state on page 199 that, if the demand made on the cell can be met, films may well replace gramophone records, and photoelectric cells become part of a normal domestic equipment

"Photoelectric Cells" is completely up-to-date, at the time of publication, and is a book that should be regarded as indispensable by physicists and most electrical engineers.

T.T.B.

Business and Industrial Notes.

The Week's Electrical Trade News from all Sources. Commercial and Industrial Developments, Business Changes, Market Prices for Materials, Trade Openings, New Publicity Literature, Liquidations, and Failures.

E.D.A. Activities.

The British Electrical Development Association has appointed Mr. E. M. Hood as officer for the two area committees organised in Scotland last year.

The first report of the North-West Area of the Association for the period October 1st, 1928, to December 31st, 1929, states that nine additional supply undertakings were enrolled. An outstanding event was the absorption by the Association in October, 1928, of the Electric Lighting Service Demonstration Bureau in the area. The number of lectures given in the Bureau, other than conferences, totalled 78, at which the aggregate attendance was 4,300. An industrial electric heating exhibition was held at Belle Vue, in conjunction with the Manchester Corporation Electricity Department in January, 1929, and a panel consisting of representatives of electricity supply undertakings and manufacturers was set up to investigate the possibilities of electric heating for process work in the textile (cotton) industries. The report also contains lists of sales conferences, local exhibitions, and lectures held during the period under review.

There was a large gathering in the Station Hotel, Newcastle-upon-Tyne, on April 2nd, on the occasion of a luncheon in connection with the North-East Area of the Association, when Mr. W. F. T. Pinkney was elected chairman of the Area, and Mr. W. Fitzgerald vice-chairman. Praise for the good work done in the Area was given by Mr. H. Marryat, who said that headquarters were looking more and more to the areas for suggestions for national work which would benefit all in the areas. In spite of the low scale of contributions, their total income (£30,000) was still not enough to adequately advertise their message to the public. Lt.-Col. W. A. Vignoles said that in the next few years there would be an enormous development in the use of electricity for industrial heating. The Association held the unique position of representing the whole industry for the benefit of which it was working, and was doing all in its power to popularise the use of electricity, the only impediment being lack of adequate funds. At present they were conducting a campaign to endeavour to get people to wire their houses sufficiently by putting in a plentiful number of plug-points, a movement which was originated by the Electrical Association for Women. The annual general meeting followed, when it was stated that the membership was increasing. Special tribute was paid to the excellent work of Mr. A. Parkin, area officer, who has been responsible for the formation of the two area committees in Scotland.

The Contractors' Conference.

As we have already reported, the fifth annual conference of the E.C.A. and Allied Associations is to be held at Llandudno from June 25th to 27th. A provisional programme published in the Association's official organ shows that the conference will follow the lines pursued in previous years. On the first day there will be a reception by the president (Mr. H. Willoughby-Ellis) at the Grand Hotel, followed by a dance. The annual general meeting will take place on the following morning, and after a civic welcome Mr. Willoughby-Ellis will deliver his presidential address. In the afternoon a paper will be read and discussed, and a smoking concert will take place in the evening. Another paper will be read on the last morning, and after the discussion the new president will be installed. A garden party is being arranged for the afternoon, and in the evening there will be a ball and supper at the Grand Hotel. For those who desire to stay in Llandudno over the week-end special arrangements are to be made. It is stated that ample accommodation will be available.

A Remarkable Incident.

From the April *Electrical Contractor and Retailer*:—

"We understand that a stiff dose of brandy had to be administered to a well-known London electrical contractor who, a few days ago, received the following letter *and enclosure* in his morning mail:—

'Sir,—In reference to your estimate of January 10th, 1930, for this work, amounting to £120 17s. 6d., I am instructed by my clients to say that, while unable to pass you the order, they feel that you have been to some trouble in preparing the estimate and therefore wish to send you the sum of five guineas in respect thereof. I therefore enclose cheque for five guineas, receipt of which please acknowledge.—Yours faithfully, &c.'

"Personally, we think that, with permission, the names of these gentlemen should be published for general information. It is a counsel of perfection not to let the left hand know what the right hand is doing; but there are occasions when a word of sincere thanks and appreciation are certainly called for."

Australian Tariff Increases.

Reuter reports that Mr. Scullin, the Commonwealth Prime Minister, announced last week that in order to bring about a decrease in imports it had been decided to prohibit the importation of certain "luxury" articles and to impose a 50 per cent. "super-tax" on others.

A schedule issued on April 4th showed that among the classes of goods, the importation of which is prohibited, are electric and gas cooking and heating appliances, wireless sets, headphones, accumulators, dry cells, and electric irons.

It is generally considered that the new measures ought quickly to adjust the unsatisfactory overseas trade position. Meanwhile, however, they will cause a considerable increase in unemployment in the distributing trades.

Mr. Page who was Treasurer in the last Government, considers that the Cabinet should have used greater discrimination, not only as regards goods, but also between countries where such goods are manufactured. If this had been done, it would have enabled Australia to give more favourable treatment to countries which treat her more favourably than those taking the smallest quantity of Australian manufactures.

East African Electrical Trade.

A report upon economic conditions in East Africa has been prepared for the Department of Overseas Trade by Mr. C. Kemp, Deputy Trade Commissioner (Stationery Office, 2s. 9d. net). In the course of this it is stated that Great Britain is predominant in the imports of electrical goods and apparatus. The only serious competition comes from Dutch electric lamp manufacturers, but, says the report, "the reason is rather difficult to seek owing to the known existence of international price agreements. The fact that the local agents for the Dutch manufacturers quote free on rail from stocks may, of course, have its influence." Although in the case of agricultural machinery Great Britain has lost some ground to Canada and the United States, this country has recovered considerably in the trade in electrical machinery and internal-combustion engines. An appendix to the report shows that in the first half of 1929, Kenya and Uganda imported electrical goods and apparatus valued at £28,127, as compared with £45,510 for the whole of 1928. Of this, Great Britain accounted for £20,632, the United States for £4,149, and Germany for £1,654. Tanganyika imported £13,924 worth of electrical goods and apparatus in the first half of 1929 (£23,284 in 1928), of which Great Britain's share was £12,452, Germany's £922, and that of the United States £185. During the first six months of last year Zanzibar's imports of this class were valued at only £2,173 (Great Britain £1,014), although in 1928 the total was £23,495. Separate statistics of electrical machinery imports are not given. In the case of Northern Rhodesia, it is shown that in 1928 imports of electrical machinery were valued at £23,691, as compared with £128,052 in 1927. Great Britain's quota fell from £124,595 to £17,170, while that of Germany rose from £2,337 to £5,394.

An Anglo-American Arbitration Scheme.

We have received from the American Chamber of Commerce in London two interesting and instructive booklets. The first of these deals in a general way with the principles of commercial arbitration, and shows that although the judgments of the British and American Courts are invariably fair and well-considered, the procedure is cumbrous, costly, and slow. The Chamber therefore decided to set up a Tribunal of Arbitration to which commercial differences could be submitted for decision. The second booklet sets out in full the rules of procedure which will govern the actions of the Tribunal. The

arbitrators will be selected by the Arbitration Committee of the Chamber and a scale of fees has been fixed for these arbitrators, for counsel employed by parties, for witnesses, &c.

The scheme is not confined to members of the Chamber; any parties engaged in Anglo-American trade can avail themselves of the Tribunal's services. The address of the American Chamber of Commerce is Aldwych House, Aldwych, W.C.2.

United States Electrical Exports.

During January last the total value of electrical machinery, goods, and apparatus exported from the United States was $12,724,353, as compared with $10,718,117 in January, 1929. The principal increases occurred in the following items:—Radio apparatus, from $1,238,289 to $1,523,207; refrigerators up to one-ton capacity, from $610,504 to $839,333; telephone equipment, from $356,300 to $831,144; transformers (including instrument transformers), from $292,591 to $717,103; switches and circuit breakers (over 10 A), from $154,109 to $380,820; and stationary motors, from $318,810 to $508,205. The leading customer was, as usual, Canada, whose share was valued at $2,829,622. The United Kingdom was second, having taken goods worth $1,156,902. It is stated that this country's imports from the United States consisted principally of insulated copper wire, furnace electrodes, insulating material, washing machines, vacuum cleaners, other motor-driven household devices, electric refrigerators, portable electric tools, accessories and parts of motors, and fractional h.p. motors. Other leading customers were: Argentina ($859,114), Mexico ($723,843), Australia ($553,494), Brazil ($521,959), European Soviet Russia ($462,390), and British India ($423,725). The imports of electrical goods into the United States in January had a value of only $154,449.

The United States Radio Industry.

An aggregate business of $135,845,635 was reported for the year 1929 by 10,455 radio equipment dealers, who embrace about one-fourth of the dealers in the United States, according to a statement issued by the Electrical Equipment Division of the Department of Commerce in conjunction with the Radio Division of the National Electrical Manufacturers' Association. Sales of 862,599 electric sets and 35,197 battery sets were reported. In 1928 sales reported by 6,569 dealers were 447,000 sets valued at $70,877,517; in 1927 sales by 7,737 dealers were 441,000 sets valued at $90,785,000.

New Municipal Showrooms.

The Eccles Town Council has accepted a tender of £11,110 for the erection of new electricity showrooms and offices.

The Australian Battery Market.

A confidential report on the market for secondary and primary batteries in Australia has been prepared by the Department of Overseas Trade from information furnished by the Senior Trade Commissioner in Australia, and issued to firms whose names are entered on its Special Register. United Kingdom firms desirous of receiving a copy of this report should communicate with the Department, 35, Old Queen Street, S.W.1.

American Trading Policy.

The United States Federal Trade Commission has approved resolutions made at trade practice conferences by members of the National Electrical Manufacturers' Association who are in the outlet box and conduit fittings industry and the manufactured electrical mica industry. The rules are divided into two groups. Those in Group I are regarded by the Commission as condemning unfair methods of competition in violation of the law, while those in Group II were accepted as expressions of the trade concerned. In Group I are such subjects as secret rebates, discrimination against customers, selling below cost, defamation of competitors, interference with contracts, enticement of employés, misbranding and misrepresentation. Group II relates to such subjects as price differentials, price list publicity, uniform contracts, secret prices, special services to customers, influencing sales by gifts, brokerage payments, split billing, guarantee against changes in price, consignment, long-term contracts, freight charges, deviation from standards, &c. For each of the industries the Commission authorised a committee on trade practices to investigate whether the resolutions were being observed and to co-operate with the Commission in making the rules effective.

American Instalment Sale Losses.

The average loss on instalment sales reported by 212 electrical appliance businesses in the United States for the year 1927 was 1.5 per cent., according to preliminary figures gathered in connection with a national retail credit survey by the Department of Commerce. One-half of these businesses, which included shops of all sizes and in different areas of the country, are reported to have shown losses of less than 0.2 per cent., but a number of them had losses of over 5 per cent. on instalment sales.

Canadian Contract for a Canadian Company.

The Beauharnois Construction Co., a subsidiary of the Beauharnois Power Corporation, Ltd., has awarded to the Dominion Engineering Works, Ltd., Montreal, the contract for the construction of four 50,000-h.p. and two 8,000-h.p. water wheels required in connection with the new power development on the St. Lawrence River. The cost of the water wheels, together with the embedded parts for six more wheels, included in the contract, is upwards of $1,000,000. Further turbines to bring the plant up to the initial capacity of 500,000 h.p. will be ordered from time to time. The Dominion Engineering Works competed successfully for the contract not only with other Canadian firms, but also with British, United States, German, Swiss, and Swedish firms.

Polish Electrical Imports and Exports.

The *Board of Trade Journal* reports that in January last Poland imported "conductors, apparatus, and other electro-technical materials" valued at 19,407,000 zl. (£447,000), while exports of these goods were valued at 125,000 zl. (£2,900).

Unemployment.

The number of persons on the registers of the Employment Exchanges in Great Britain increased by 17,042 during the week ended March 24th. At that date the total was 1,638,800, as compared with 1,621,758 on March 17th, and 1,132,856 on March 25th, 1929.

Dual-frequency Starters.

Referring to the recent correspondence in the Electrical Review on "Motor Users and the Frequency Change," Messrs. Erskine, Heap & Co., Ltd., state that they supply starters of the star-delta or auto-transformer types, having the usual overload and no-volt protective devices, which can be used on either 25- or 50-cycle circuits, without alteration.

The Easter Holidays.

The offices of New Distributors of Edison Storage Batteries, Ltd., Victoria House, Southampton Row, W.C.1, will be closed from noon on April 17th until the morning of April 22nd.

The offices of the Jackson Electric Stove Co., Ltd., will close for the Easter Holidays on the evening of April 17th and will re-open on Wednesday, April 23rd.

A Novel Ash Tray.

We have received from the Nox Electric Lamp Co., Ltd., Clarence Road, Hunslet, Leeds, a neat ash tray made from a moulded compound in the form of a section of one of the company's lamps.

"Safety First."

The National "Safety First" Association, 119, Victoria Street, S.W.1, has inaugurated a special accident prevention service for industrial undertakings. Briefly, this consists of an intensive campaign each month against one of the principal risks of industry. Weekly posters deal with various aspects of that particular risk, which is the most prolific of accidents. These are reinforced by special bulletins for the management, and pocket magazines "On Guard" for the worker. The first bulletin is entitled "Handling Goods," and deals with the treatment of the various accidents which may happen in the processes of lifting and moving in industry. The booklet is written in an interesting manner, and contains notes on many "Safety First" matters.

The Liége International Exhibition.

The Palais de l'Electricité promises to be one of the most important sections of the International Exhibition which is to be opened next month in Liége, Belgium, and will continue until October. A large portion of the ground floor space will be occupied by exhibits which are being got together by three large Belgian groups—the Association des Constructeurs de Matériels Electriques Belge, the Association des Centrales Electriques en Belgique, and the Union des Exploitations Electriques Belges, the object being to demonstrate the capabilities of Belgian electrical engineering concerns and the great development of the electricity supply undertakings in the country.

Book Notices.

"Patents and Trade Marks," by Benjamin J. King (King's Patent Agency, 146a, Queen Victoria Street, E.C.4). (28 pp.) This is a new edition of a useful handbook dealing with the nature of patents and the procedure for obtaining them. The matters covered include employés' inventions, foreign patents, fees, &c. Trade marks are similarly treated, and there is a brief note on copyright. The booklet is obtainable gratis from the above address.

The *Henley Telegraph* for March continues "W.A.M.'s" history of Henley's which contains many interesting facts, some hitherto unpublished; a memoir of Mr. A. A. Campbell Swinton appears, and there are numerous notes and articles upon the various phases of the company's and staff's activities, including the Welfare Department at the Woolwich works, and the presentation of long-service certificates.

"Radio Data Charts," by R. T. Beatty. Pp. 82. London: *Wireless World*. Price 4s. 6d. net.

"Transactions of the Institution of Engineers, Australia, 1927." Vol. XIII. "*Journal* of the Institution of Engineers, Australia." Vol. II, No. 2, February, 1930. Sydney: The Institution. Price 7s. 6d.

"Modern Steelwork," edited by W. R. Gilbert. Pp. 334; illustrated. Price 5s. London: The British Steelwork Association.—A review of current practice in the employment of structural steelwork in buildings and bridges.

New Swiss Companies.

Two new concerns having for their object the financing of electrical undertakings, have lately been formed in Switzerland—the Finelectra Finanzgesellschaft für Elektricitäts Beteiligungen, Zurich (1, St. Peterstrasse), and the "Hephasei" Gesellschaft für Motorische Krafterzeugung, Zurich (12, Freigutstrasse).

Greek Electrical Developments.

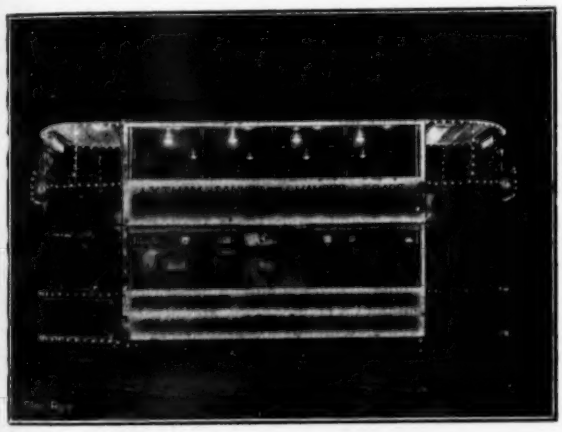
The formation is announced from Athens of a Greek-Italian company under the auspices of the Greek National Bank and the Banca Commerciale Italiana e Greca, and under the title of the Société Hellenique d'Electricité Galileo, with a share capital of 100,000,000 drachmai. The National Bank of Greece and the Hellenic General Trust, (part of the latter's capital is British) are participating in the new company, most of whose capital is said to be Italian. The object is to establish hydro-electric works in Greece.

The Export Credits Scheme.

The Government had decided to extend the period of operation of the Export Credits Guarantee Scheme, which would have normally expired in September next year, until March 31st, 1935.

An Illuminated Tramcar.

An attractive feature of the recent exhibition held at Lytham-St. Annes by the Chamber of Trade, was an illuminated tramcar which was employed to advertise the



An Illuminated Tramcar at Lytham-St. Annes.

exhibition. The car, which is shown in the accompanying illustration, was equipped with over 1,600 14-V, 7-watt "Osram" lamps.

Estonian Foreign Electrical Trade.

During January last electrical machines, apparatus, and implements valued at 243,700 kr. (£13,390) were imported by Estonia. Exports of this class had a value of 34,500 kr. (£1,900).

Bankruptcy Proceedings.

Margaret K. Clements (trading as K. Raymond), wireless apparatus dealer, 27 and 28a, Lisle Street, Leicester Square, W.C.—This debtor attended on April 2nd before Mr. Registrar Warmington at the London Bankrupcty Court for public examination upon accounts showing total liabilities of £5,717 (unsecured £5,359), and net assets valued at £1,009. Mr. C. R. Waterer, Deputy Official Receiver, said he had called upon the debtor to furnish a cash and goods account dating from April 6th, 1929, to the date of the receiving order. During the last 10½ months of the trading a substantial amount was alleged to have been lost on the trading. The examination was adjourned till May 14th, and the debtor was ordered to supply the required account.

According to the Official Receiver's observations the debtor states that she commenced business in July, 1928, with a capital of £100 in the name of "K. Raymond." In March, 1928, she sustained a loss of about £130 as the result of a fire, against which risk she was not insured; as a result of the fire she was deprived of the use of the premises for about six months. The business was successful until about three years ago, since when heavy losses had been sustained mainly attributable to price-cutting, excessive advertising, and debtor's ill-health. At a meeting of creditors held on February 11th last it was agreed, subject to all her creditors consenting, to sell the business for £1,050. Some of the creditors dissented, and the present proceedings were instituted.

H. G. Edghill, 13, Wembley Hill Road, Wembley, electrical and radio engineer.—The receiving order herein was made recently on the debtor's own petition, and according to the statement of affairs there are liabilities amounting to £636 against assets of £129. The following are creditors:—

	£		£
A. J. Dew & Co. ...	158	Philips Lamps, Ltd. ...	98
Dulcetto Polyphon, Ltd.	116	A. H. Green	150

C. Austin (C. Austin & Son, and Austin's Accumulator and Radio Service), wireless accessories dealer, 97, Domestic Street, Leeds.—Last day for proofs for dividend, April 26th. Trustee, Mr. H. C. Bowling, Official Receiver, 24, Lower Bond Street, Leeds.

J. Goodrick, electrician, Terrington, Offerton Lane, Stockport.—First meeting held April 8th at the Official Receiver's office, Byrom Street, Manchester. Public examination, April 25th, at the Court House, Stockport.

J. A. Cane, T. P. Cane, and D. R. Cane (Cane Bros.), consulting and electrical engineers, Sturry, Kent.—Trustee, Mr. S. E. Foster, 29, Bank Street, Ashford, appointed March 29th.

R. C. Hudson, electrical contractor, &c., 1 and 2, Bridge Road, Chatburn, Lancaster.—First and final dividend of 10d. in the £, payable at the Official Receiver's office, District Bank Chambers, Blackburn.

Company Liquidations.

Triotone, Ltd., 41, Wigmore Street, W., and Factory Lane, Bruce Grove, Tottenham, N. Under the compulsory liquidation of this company the report of Mr. G. D. Pepys, Senior Official Receiver and Liquidator, has been issued, together with a summary of the accounts, showing total liabilities of £7,227, assets valued at £651, and a deficiency of £11,825 with regard to contributories, the issued capital being 5,000 "A" £1 and 5,000 "B" 1s. shares. The company was registered as a private company in July, 1928, with the object of carrying on business as manufacturers of and dealers in "Triotone" gramophone radio instruments, radio apparatus, &c. The promoter was Mr. Maryon C. Hieger, and he was the sole director as well as the principal shareholder. It was the intention at a later stage, when various models of radio-gramophones had been perfected, to form a public company to take over the business. The company traded for about one year, the accounts for the period showing a gross loss of £837. In May, 1929, the company was being pressed by creditors, and on June 7th a loan of £700 was obtained on the security of a 6 per cent. debenture bond for the same amount. Later in the month another creditor levied execution, whereupon Mr. S. B. Hereford was appointed receiver and manager for the bond holder. In the opinion of that official there is no prospect of sufficient funds becoming available to meet the debenture holder's claim. The company's failure is attributed by Mr. Hieger to insufficient capital and to the fact that the arrangements made for the flotation of the proposed new company were abortive.

Mersey Radio and Gramophone Co., Ltd., 19, Water Street, Liverpool.—The statutory meeting of creditors was held on April 3rd at Liverpool. The statement of affairs showed ranking liabilities of £1,013, and net assets of £863, leaving a deficiency of £150. The company was registered in August, 1928, when it took over a successful existing business. The nominal capital was £3,000, of which £2,250 had been issued. The turnover had been insufficient to meet the expenses. A resolution was passed in favour of the voluntary liquidation of the company being continued with Mr. A. T. Eaves, 47, Mosley Street, Manchester, as liquidator, with a committee.

The following are creditors:—

	£		£
General Electric Co., Ltd.	64	Rothermel Corporation, Ltd.	27
Mullard Wireless Service Co., Ltd.	53	Radio Instruments, Ltd.	46
Pulford Bros., Ltd. ...	41	Kodak, Ltd.	40
Pathescope, Ltd.	35	Gramophone Co., Ltd. ...	37
		John Moores & Co. ...	213
		W. H. Woodyer	208

Knighton Electric Supply Co., Ltd.—Winding up voluntarily. Liquidators, Mr. W. Lloyd, Priory Street, Dudley, and Mr. P. Parker, Council Offices, Knighton. Particulars of claims to the liquidators by April 21st.

Universal Accumulators, Ltd.—A meeting of members is called for May 9th at Adelaide House, King William Street, E.C., to hear an account of the winding up from the liquidator, Mr. C. A. Frith.

Telephone Bureau, Ltd.—Winding up voluntarily. Liquidator, Mr. L. Vernon Smith, 25-27, Oxford Street, W.

Kye, Ltd.—First and final dividend of 1s. 3d. in the £ payable at the offices of Messrs. Poppleton, Appleby & Hawkins, 4, Charterhouse Square, E.C.

Broadfield Radio Co., Ltd.—A meeting of members is called for May 1st at 3, Victoria Place, Haverfordwest, to hear an account of the winding up from the liquidator, Mr. R. Warren.

D

Private Arrangement.

Electramonic Co., Ltd., 1, Budge Row, E.C.4.—At a creditors' meeting on April 2nd, one of the directors, Mr. Gerrald-Nathan, stated that he was chairman of the committee of investigation which was elected at the last meeting of the shareholders. The present position was that there was a liability to the bank of £537; preferential creditors claimed £315; and there were creditors under £10 amounting to £397. The creditors over that amount were £4,750, and in addition there were directors' fees of £957. The solicitors' costs were scheduled at £2,000, and money advanced to the company by Mr. Sayers amounted to £3,985. The total assets were in the neighbourhood of £24,000, and it was proposed that a scheme of arrangement should be entered into with the creditors. The company proposed that all the creditors under £10 should be paid in full, and creditors over that amount should receive 10s. in the £ in cash, and that they should take notes for the balance to be spread over a period of 24 months with an option to redeem at earlier dates, if necessary. The chairman added that all claims against the Celestion Company had been wiped out, and there was a hope of the company doing good business in the future. The creditors decided to accept the scheme of arrangement, and it was intimated that the company would go into voluntary liquidation and a new company would be formed.

Dissolutions of Partnership.

W. & T. Marshall, electricians, Stirling.—Messrs. T. Marshall, W. Marshall, and W. Marshall, jun., have dissolved partnership. Mr. W. Marshall and Mr. W. Marshall, jun., will continue the business under the style of W. Marshall and Son.

Turner & Booth, electrical engineers, 51, Church Street, Radcliffe.—Mr. E. Turner and Mr. W. Booth have dissolved partnership. Mr. Turner will attend to debts.

Driver & Peterson, plumbers, &c., and electrical contractors, 398, Stanhope Road, Back Westoe Parade and Albany Street, South Shields.—Mr. T. L. Peterson and Mr. S. C. Driver have dissolved partnership.

Taylor & Edmonds, 17, Abbey Street, Accrington.—Mr. J. R. Taylor and Mr. F. Edmonds have dissolved partnership. Mr. Edmonds will attend to debts and continue the business on his own account.

New Catalogues and Lists.

Messrs. Dorman & Smith, Ltd., Ordsal Electrical Works, Salford, Manchester.—Several illustrated leaflets dealing with the company's distribution boards, iron and brass fittings, main switchboards, and brass and iron glands.

Mr. Cuthbert Andrews, 47, Red Lion Street, W.C.1.—A card summarising reports by the National Physical Laboratory on the "Protexray" tube.

Messrs. Smith & Davis, Ltd., Hampton Street, Birmingham.—A booklet drawing attention to the company's belt fasteners and summarising a report by the Civil Engineering Department of the Birmingham University of tests of the strength of belt joints made by all the popular belt fasteners.

Saxonia Electrical Wire Co., Ltd., Roan Works, Greenwich, S.E.10.—Illustrated list No. 11,029 of the company's mercury switch tubes for a.c. and d.c.

Venner Time Switches, Ltd., 45, Horseferry Road, S.W.1.—Illustrated price list No. 50a, describing time switches for shop window lighting, protective lights, signs, &c.

Messrs. A. C. Cossor, Ltd., Highbury Grove, N.5.—A number of illustrated leaflets dealing with the company's various types of radio valves.

Messrs. Heenan & Froude, Ltd., Worcester.—Publication No. 91, describing the new "Heenan" electrodynamotor. Illustrated.

Messrs. Herbert Morris, Ltd., Loughborough.—Book No. 449, dealing with Morris conveyors, with illustrations of some of the installations carried out by the company.

Messrs. Crompton Parkinson, Ltd., Guiseley, Leeds.—Specification No. A402 describing the company's transformers. Illustrated.

Higgs Motors, Witton, Birmingham.—April stock list of the company's a.c. and d.c. motors and dynamos.

B. E. N. Patents, Ltd., 92, Tottenham Court Road, W.1.—List No. C.B.8 containing illustrated particulars of the company's air units and paint-spraying equipment.

Messrs. F. C. Blackwell & Co., Ltd., Great Crosby Works, Liverpool.—An illustrated price list of "Blaco" all-steel conduit fittings.

British Thomson-Houston Co., Ltd., Rugby.—Pamphlet No. D.S.7511 describing the type P.E.7 photo-electric cell. Illustrated.

Philips Lamps, Ltd., 145, Charing Cross Road, W.C.2.—An illustrated leaflet giving particulars of the floodlighting arrangements at a recent football match at Mansfield.

Messrs. Drake & Gorham, Ltd., 36, Grosvenor Gardens, S.W.1.—Pamphlet No. 473 containing illustrations and prices of vacuum cleaners and floor polishers.

Brookhirst Switchgear, Ltd., Northgate Works, Chester.—A reprint of an article from the *Motor Ship* on ships' electrical safety precautions in which the company's motor-starting panels are described and illustrated.

British Insulated Cables, Ltd., Prescot.—Catalogue No. P.253 dealing with "Prescot" copper and aluminium sheets and sections. Illustrated.

Messrs. Donovan & Co., 47, Cornwall Street, Birmingham.—A comprehensive catalogue (pp. 163) containing illustrated particulars and prices of apparatus for the control of circuits up to 660 V. Reference is facilitated by a very complete index, and the publication (list No. 3041) is bound in a stout cardboard cover.

Messrs. A. F. Bulgin & Co., 9/10/11, Cursitor Street, Chancery Lane, E.C.4.—A catalogue of the company's radio products, including a manual giving instructions, information, and wiring diagrams. Illustrated and priced.

Messrs. F. E. Potter, Ltd., Imperial House, Kingsway, W.C.2.—A portfolio containing examples of recent advertisements prepared by the company.

Trade Announcements.

Messrs. Cantwell, Son & Co., electrical engineers and contractors, of Broadstairs, have removed to larger premises in Upton Road.

The Metropolitan-Vickers Electrical Co., Ltd., informs us that it has found it necessary to build new premises to house its London district meter staff, and give the storage facilities that its rapidly increasing business requires. All correspondence formerly addressed to the London office concerned with meters, instruments and relays, should now be addressed to the company at Gorst Road, Park Royal Road, N.W.10. (Telephone: Willesden 5083.)

As from April 14th, the Birmingham office address of the Metropolitan-Vickers Electrical Co., Ltd., will be Wellington House, 39, Bennetts Hill, Birmingham. (Telephone Nos.: Central 2801 and 2802.)

Messrs. Shimwell, Alexander & Co., 82, Fenchurch Street, E.C.3, have been appointed by the Alpha Electrical Apparatus Co., Birmingham, as sole distributing agents for its domestic appliances for the counties of Kent, Sussex, Surrey, Hampshire, and Dorset. They are arranging for a stock of this apparatus to be held at their offices and showrooms, 110, High Street, Southampton.

The Cressall Manufacturing Co. has appointed Mr. A. J. Taylor, 6, Colney Hatch Lane, N.10, as agent for the Eastern Counties—Essex, Middlesex, and Hertfordshire outside the Metropolitan Postal District.

The Curtis Manufacturing Co., Ltd., states that its only works and offices are at Conduit Place, Paddington, W.2, and 32, Spring Street, Paddington, W.2, respectively, and that it has no connection with any other firm of similar name.

Messrs. J. Calvete, Ltd., state that owing to the expansion of their business they have found it necessary to centralise and equip head offices and showrooms adjacent to the factory. Their only address is now 59, North Street, S.W.4 (Telephone: "Battersea 4634; telegrams: "Elecalvete, Clapcom, London.")

Messrs. W. F. Dennis & Co., 70, Queen Victoria St., E.C.4, have resumed the sale of "Neptune" brand rail bonds, manufactured by Messrs. Felten & Guilleaume, Carlswerk, A.G.

The London office of Messrs. Daniel Adamson & Co., Ltd., turbine and boiler engineers, has been moved to Craven House, 16, Northumberland Avenue, W.C.2. Telephone: Regent 1795; telegrams: "Flangeseam, Westrand, London."

Recent Contracts.

The following are among the orders recently received by the English Electric Co., Ltd.: (*a*) 450 "English Electric" Type CDB.2, Form F, hand-operated camshaft tramcar controllers for the Glasgow Corporation; they will be similar to those previously supplied, and the value of the contract is £26,000; (*b*) 94 maximum traction type tramcar trucks fitted with roller bearings, 28 in. diameter driving wheels, 4 ft. 6 in. wheel base, for the Union Construction Company for service with the London United Tramways; the value of this order is about £14,000; (*c*) three additional double-deck "English Electric" 'bus bodies to seat 50 passengers, mounted on A.E.C. "Regent" chassis, for the Newcastle Corporation.

British Insulated Cables, Ltd., has obtained the contract for the supplying and laying of the Post Office trunk cable from Liverpool to Colwyn Bay. About 54 miles of cable will be required for this contract, the value of which is approximately £60,000. Another order secured is for 150,000 rail bonds for the Southern Railway, the value being about £20,000.

The Times Trade and Engineering Supplement reports that for the new Cauvery Metur dam scheme in Madras, India, Glenfield & Kennedy, Ltd., are providing 16 free-roller sluice gates on the spillway, a new design of emergency roller sluice gate, mechanically-operated needle valves, and jet dispersers. During the building of the dam, and until the power station is constructed, four needle valves of 8 ft. 6 in. inlet diameter will be operated, fitted with jet dispersers of 6 ft. effective diameter, which will each pass 2,000 cusecs of water under a head of 180 ft. In this way the impounded water, before the turbines are operating, can be passed down to the river without difficulty, all the energy being harmlessly dissipated by the dispersers.

Central Board Contracts.

The Central Electricity Board has placed the following contracts: (1) With the Enfield Cable Works, Ltd., for certain 132-kV overhead transmission lines in connection with the

North-West England and North Wales Electricity Scheme, 1928; and (2) With Messrs. Watsham's, Ltd., and W. T. Henley's Telegraph Works Co., Ltd., London, for 33-kV overhead transmission lines in connection with the South-East England Electricity Scheme, 1927. The approximate total value of the contracts is £320,000.

The Timber Market.

Our Timber Trade Correspondent reports that European timber stocks in the country are fairly large compared with a year ago, but on the other hand, the demand continues to be better. Forward business from Russia, Sweden, and Finland, the principal suppliers, is backward. British importers are waiting for what they think will be rock bottom prices, but it is considered very likely that holdings in this country will be ample this year. Hardwood logs are very firm in value, especially mahogany and teak, but sawn hardwood operators find stocks large and competition keen. Plywood stocks are large, and demand both for spot and forward goods has tapered off.

Prices of Materials.

Messrs. F. Smith & Co. report, April 8th: Copper (electrolytic), bars £84 6s. 3d., 1s. 3d. inc.; do. do. sheets, no change; do. do. wire rods, £94 6s. 3d., 1s. 3d. inc.; do. do. h.c. wire, no change.

Messrs. James & Shakespeare report, April 8th: Copper bars (best selected), sheet and rod, no change. English pig lead, £19 15s., 15s. dec.

Messrs. Edward Till & Co. report, April 8th: No change in the price of india-rubber, Para fine.

Messrs. James Forster & Co. reported on April 5th that there was a very quiet tone in the lead market last week, and with no support given to the market, prices had a sagging tendency and closed at the lowest. Demand from home consumers has quietened down again, and, with the Continental demand as dull as ever, it is not surprising that prices are slipping away to a lower level. Arrivals are ample for current needs, and seem likely to remain so for some time. Unless there is a radical change in the present state of affairs, there is nothing to prevent values falling further.

Lighting and Power Notes.

Barrow.—REVISED ELECTRICITY CHARGES.—The Town Council has adopted the following revised scale of charges for electricity in Barrow:—Lighting flat-rate: First 100 kWh per quarter, 6½d. per kWh; next 100 kWh, 6d.; all over 200 kWh, 5½d. Alternative lighting rate for premises other than dwelling houses: A fixed charge based on £20 per kW per annum, plus 1d. per kWh consumed. Alternative domestic lighting rate: A fixed charge based on £20 per kW per annum, plus ¾d. per kWh. Flat-rate for heating, cooking, and water-heating: ¾d. per kWh, with a meter rent of 2s. 6d. per quarter; for an additional ¼d. per kWh consumers are supplied with a radiator or cooker free of charge, subject to their guaranteeing to use from 500 to 1,000 kWh per annum according to the apparatus supplied. Motive power: First 250 kWh per quarter, 3d. per kWh; next 250 kWh, 2½d.; next 500 kWh, 2d.; above 1,000 kWh, 1½d. Alternative tariffs for power: (*a*) A fixed charge based on £6 per kW per annum, plus 1d. per kWh; or (*b*) a fixed charge based on £8 per kW per annum, plus ¼d. per kWh, with a meter rent of 2s. 6d. per quarter. For energy supplied in Dalton and rural district the tariffs are the same as those given above with the addition of ¼d. per kWh, except in the case of the lighting flat rate, where an extra 1¼d. per kWh is charged.

BULK SUPPLY AGREEMENT.—Arrangements have been made for the Corporation to give a bulk supply of electricity to the Cark and District Electricity Co., Ltd.

Bath.—BULK SUPPLY SCHEME.—In connection with the anticipated increased demand for bulk supply to the West Wilts Electric Light and Power Co., Ltd., the city electrical engineer has prepared a scheme, estimated to cost £40,935, for the provision of an alternative supply.

Bromley (Kent).—BULK SUPPLY APPARATUS.—In connection with the proposed laying of extra cables for bulk supply, the Town Council has decided to replace the 11,000-V switchboard at an estimated cost of £2,050, and to add an extra panel to the 3,300-V switchboard to control the new transformer at an estimated cost of £130. It is proposed to spend £5,000 on general sub-station equipment and transformers.

Canada.—HYDRO-ELECTRIC DEVELOPMENT.—The Southern Canada Power Co., Ltd., has applied to the Quebec Public Service Commission for authority to construct a power development on the St. Francois River, about six miles north-west of Drummondville, Que., at an estimated cost of $6,000,000. As part of the scheme would involve the flooding of about 1,300 acres it is opposed by some of the municipalities affected.

ONTARIO GOVERNMENT ACQUIRES ELECTRICAL SERVICES.—The acquisition, by the Ontario Hydro-Electric Power Commission, of extensive tramway and electric power services mainly in the Niagara district owned by the Dominion Power Transmission Company of Hamilton, is officially announced. The cost of the acquisition is $21,250,000. The transaction is subject to ratification by the shareholders of the Dominion Power Company.—*Reuter* (Toronto).

Chile.—ELECTRICITY SUPPLY.—According to an official report, the total capacity of the electric power plants in operation in Chile at the end of 1928 was 205,316 h.p., of which 139,682 h.p. was generated by water power and 65,634 h.p. by steam. There were 159 plants in operation, of which 55 used water power, 27 wood, 24 oil, and 27 coal, while 26 were mixed plants. The use of electricity has increased rapidly in recent years, production having been estimated at 500,000,000 kWh in 1920, steadily rising to 1,020,000,000 kWh in 1928.

Colchester.—ELECTRICITY SUPPLY.—The City Council has decided to erect l.p. lines in St. Osyth and in Kirby Cross with Lower Kirby, at an estimated cost of £1,445 and £1,825 respectively. The Electricity Commissioners have informed the Council that the section of the main transmission system between Rayleigh and Colchester will be completed by October, 1931, and that supplies from this source will be available to the Corporation by that date, and in these circumstances the Commissioners are of opinion that it is unnecessary for the Corporation to give further consideration to the question of the installation of additional plant at the generating station.

Continental.—SWEDEN.—The Lanforsen hydro-electric power station now being constructed on the Dalaelven River is nearing completion. The machinery has already been installed and only the electrical equipment remains to be fitted. The mechanical equipment consists of two Kaplan type turbines of 13,000 h.p., directly coupled to three-phase generators of 10,000 kW. A third set of the same size will be installed in the autumn of 1931. The electrical equipment was supplied by the A.S.E.A. workshops and the turbines by Karlstads Mekaniska Verkstads Aktiebolag. The new power station is owned by the town of Stockholm and the Sandviken ironworks in common, the former holding two-thirds of the share capital and the latter one-third. Power will be supplied to the town and the works in the same proportion.—*Reuter's Trade Service* (Stockholm).

GERMANY.—The Brown-Boveri Co., of Mannheim, Germany, is at present engaged on the construction of four 35,000-kVA generators for the new Ryburg-Schworstadt hydro-electric power station which is being built on the Upper Rhine.

Ealing.—WATER-HEATING CHARGES.—The Corporation Electricity Committee has introduced the following charges for electricity supplied for water heating: Consumers of under one kW on constant load of 24 hours per diem throughout the year, 0.675d. per kWh. Off-peak load, not exceeding 3 kW, 1d. per kWh. Unrestricted supply, up to 4 kW, £1 per kVA per quarter of the capacity of the heating installation plus ¾d. per kWh consumed. Supply between 10.30 p.m. and 6.30 a.m., up to 3 kW, ¼d. per kWh.

Glasgow.—CHANGE OF FREQUENCY.—In connection with the proposed change of frequency from 25 to 50 cycles at Port Dundas station, the Corporation Electricity Committee has agreed to certain modifications in the layout of the station plant, &c., while the work is going on, involving an expenditure of approximately £3,750.

MAINS EXTENSIONS.—The Corporation Electricity Committee recommends the extension of distributing mains at a cost of £21,636.

Guildford.—HIRING OF APPARATUS.—The Corporation Electricity Committee has decided to let out on hire electric cookers, water boilers, radiators, kettles and irons.

MAINS EXTENSIONS.—The Committee has also decided to extend mains at an estimated cost of £951.

Hull.—LOAN SANCTIONED.—The Corporation Electricity Committee has obtained sanction to the borrowing of £68,386 in connection with the supply to its extended area.

Irish Free State.—TIPPERARY.—The Urban District Council has decided to convert the lighting of the town from gas to electricity.

Japan.—NEW POWER STATIONS.—The Uji-gawa Electric Co., Ltd., is contemplating the erection of an 80,000-kW steam power station on the Kizu River, Osaka, and an application for official sanction has been made. It is stated that the Osaka Municipal Electrical Bureau is also considering the construction of a steam power station having a capacity of 30,000 kW on the Aji River, Osaka.

Kingston-on-Thames.—PLANT EXTENSION.—On April 9th the Corporation electricity works extensions were formally opened by Sir John Brooke, Vice-chairman of the Electricity Commissioners, and Lady Brooke started for service the new 3,750-kW steam turbo-generator set. The visitors were later entertained at luncheon.

Lathom and Burscough.—Inquiry.—An inquiry was held last week at Burscough by Col. T. C. Ekin, to consider the rival claims of Lathom and Burscough Urban District Council and the Lancashire Electric Power Co. to supply electricity for domestic purposes in Lathom, Burscough, Skelmersdale, and West Lancashire. The Council claimed to be able to give a cheaper supply to Lathom and Burscough than the Lancashire Electric Power Company. Any profit should go to the ratepayers and not to a private company. The Council proposed to sell electricity at 8d. per kWh for domestic supply and 1d. per kWh for power purposes, with alternative tariffs. Evidence was given by Mr. James Scott, the Council's electrical engineer, who quoted the results achieved by the Formby Urban District Council. The annual net profit of the Formby undertaking for five years was £852, and for the first year's working at Maghull and Lydiate there was a profit of £500. Similar results were possible at Burscough. Mr. W. Gorman, for the Lancashire Electric Power Co., said that unless the company had the whole of the area for which it applied, it would be impossible for it to develop the West Lancashire and the Wigan rural areas. No authority or company was justified in spending the ratepayers' or shareholders' money unless there was a likelihood of the scheme being carried out on an economic basis. Mr. C. D. Taite, the engineer for the company, said that it had 21 Provisional Orders, all of which were now operating in full or in part. Without an Order for the whole of the district for which they applied, it would not pay the company to develop the district outside Lathom and Burscough. If Lathom and Burscough Council was successful in its application, the power company would drop the whole scheme.

Leeds.—Co-ordination of Gas and Electricity Departments.—The Corporation Gas Committee, whose undertaking reports a deficit of nearly £60,000 on its working for the year ended March 31st, has submitted a resolution to the City Council suggesting consultation between sub-committees of the Gas and Electricity Committees with a view to finding means for co-ordinating the services of the two departments in order to reduce the existing keen competition between them. The City gas engineer and general manager has been instructed to secure information from other gas undertakings as to the effects of assisted electric wiring schemes on gas services.

Liverpool.—New Plant and Switchgear.—The Corporation Tramways and Electric Power and Lighting Committee has authorised the city electrical engineer to install four 1,000-kVA transformers and one l.p. switchboard in the Garston sub-station, at a cost of £2,350; and a l.p. distributing board in the Breeze Lane sub-station in place of an existing board, at an estimated cost of £300.

London.—Southwark.—The Borough Council Electricity Committee recommends that an arrangement be entered into with the City of London Electric Lighting Co., Ltd., for the purpose of taking from the company a bulk supply of 2,000 to 2,400 kW throughout the year. It is proposed in normal circumstances to utilise the Council's own generating plant during the peak load periods to meet any demand in excess of the bulk supply. The Committee recommends that application be made for sanction to a loan of £35,000 to meet capital expenditure in connection with the above scheme.

Longsdon.—Inauguration of Supply.—The electricity supply for the village provided by the Leek Urban District Council was inaugurated recently. The present scheme has cost between £2,000 and £3,000, and the sub-station has been designed so that it may at a later date be able to provide supplies for Cheddleton and other neighbouring areas.

Plymouth.—New Plant.—At a meeting of the Corporation Electricity Committee held recently, the chairman and engineer reported on their interview with the Electricity Commissioners in connection with the Committee's application for sanction to a loan of £106,300 for a new turbo-alternator, foundations and boilers, &c. The Commissioners intimated that they were prepared to consider at once the application so far as it related to the provision of two boilers and four main feeder switches, and that the application in respect of the remainder of the plant, &c., would be reviewed in the autumn. It was decided to apply for sanction to the borrowing of £26,168, the estimated cost of two boilers and four main feeder switches.

Bulk Supply Agreement.—The Cornwall Power Co. has agreed to the Electricity Committee's terms for supplying electricity in bulk from the Corporation's station.

Price Reductions.—Reductions in the charges for electricity have been made or recommended in the following districts:—

Beddington.—*South Metropolitan Electric Tramways and Lighting Co., Ltd.*—Lighting: From 5½d. to 5d. per kWh.

Bournemouth.—*Bournemouth and Poole Electricity Supply Co., Ltd.*—Lighting: From 6d. to 5½d. per kWh.

Watford.—Two-part tariff minimum fixed charge: (*a*) For the borough, Abbots Langley, and Bushey, from £5 to £4 12s. 6d. per annum; (*b*) for Aldenham, from £5 10s. to £5 per annum. Slot meter supplies: (*a*) For the borough, Abbots Langley, and Bushey, to 7½d. per kWh; (*b*) for Aldenham, to 8d. per kWh.

Retford.—Loan Sanctioned.—The Town Council has received sanction to the borrowing of £6,314 in connection with its electricity scheme at Tuxford.

Rye.—Inquiry.—An inquiry was held recently at the Town Hall, Rye, into the proposal of the Central Electricity Board to erect overhead lines from Hastings to Folkestone. The Ministry of Transport was represented by Mr. Gordon Tucker, and the principal opponents were the East Sussex County Council, the Coghurst Estate, Ltd., and various local landowners. The result of the inquiry will be made known in due course.

Sheffield.—Electricity Supply Application.—The Corporation Electricity Committee has received an application from the clerk to the Beighton Parish Council for a supply of electricity throughout the whole of the parish, which includes Beighton Village and Hackenthorpe, and has agreed to give the supply on terms to be arranged.

Special Order.—The Committee is applying for a Special Order authorising the extension of the existing area of supply so as to include the urban district of Dronfield.

Mains Extensions.—The Committee has approved extensions to street mains costing £4,569.

Sleaford.—Proposed Transfer of Undertaking.—Mr. Borlase Matthews has written to the Urban District Council Electricity Committee stating that the Electricity Commissioners have granted the Lincolnshire Electricity Special Order, which has yet to be formally approved by the Sleaford Council and inquiring whether the Council would be prepared to transfer its undertaking to the public utility company which is in course of formation to operate the Order. He states that the immediate advantage to the ratepayers would be lower charges for electricity.

Stamford.—Alternative Domestic Tariff.—The Urban Electric Supply Co., Ltd., has introduced the following domestic tariff as an alternative to the existing flat rate:—For residences having a rateable value of £12 or under: A fixed charge of £3 per annum, plus 1½d. per kWh for all purposes. For residences of over £12 rateable value: A fixed annual charge equal to 25 per cent. of the rateable value, plus 1½d. per kWh.

Stockton.—Assisted Wiring Scheme.—The Town Council has received sanction to a loan of £1,000 for the provision of house-wiring installations on the hire-purchase system.

United States.—Government Operation of Muscle Shoals Plant.—The Senate has approved a Bill for the operation by the Government of the $100,000,000 power and nitrate plant at Muscle Shoals, on the Tennessee River. The Bill is virtually the same as that passed by Congress two years ago and given a "pocket" veto by Mr. Coolidge, who was then President.

York.—Loans.—The Corporation Electricity Committee recommends that application be made for sanction to loans of £4,000 for assisted wiring, and £12,000 for the purchase of domestic apparatus to be let out on hire.

Tramway and Railway Notes.

Colchester.—Tramway Abandonment.—The Minister of Transport has granted the Corporation permission to abandon its tramway system.

Continental.—Sweden.—The State Railways have ordered from the Allmänna Svenska Elektriska Aktiebolaget eight more electric locomotives of a type that has not hitherto been used in Sweden. Among other special features, the driver's cabin will be in the middle of the locomotive. The price of the new engines is to be Kr. 129,000 each.—*Reuter's Trade Service* (Stockholm).

Germany.—In connection with a scheme for the acceleration of its system, the Berlin District Railway has ordered 162 new coaches, involving an expenditure of £900,000. The trains will be run at an average speed of 27 m.p.h.

Glasgow.—Opposition to Railway Electrification Proposal.—The L.N.E.R. and L.M.S. Railway Companies have decided to offer joint opposition to the proposal of the Corporation to compel companies, in the interests of a purer atmosphere, to electrify the city railways within a five miles radius of the centre of the city. The proposal is contained in a Bill remitted by Parliament to a select committee for examination. The estimated cost of such a scheme is between eight and nine million pounds, and it is now regarded as probable that the Corporation, in view of the railway opposition, will abandon the proposal. It is believed, however, that the directors of the L.M.S. Railway Company have asked for a report from the local engineers regarding the cost of electrifying part of the system in Glasgow and district. The Cathcart circle, an important suburban line, is considered to be favourable for an experiment of this kind.

Japan.—Power Station Construction.—The I.G.R. has decided to commence work on the construction of its new hydro-electric station on the Shinano River about next June. The work is to be spread over eight years, and the expenditure for the next fiscal year is estimated at 2,500,000 yen.

New Electric Railway.—A start has been made by the Keiki Electric Railway on the construction of the 11 miles of railway between Kameoka, in the suburbs of Kyoto, and Myeken, Nose, and it is expected that the work will be com-

pleted in August or September next. The construction of another line between Kameoka and Kyoto is also being considered.

Llanelly.—CORPORATION PURCHASES TRAMWAY SYSTEM.—The Town Council has decided to purchase the tramway system of the Llanelly and District Electric Lighting and Traction Co., Ltd., at a cost of £25,000. The Corporation intends, if Parliamentary sanction is obtained, to replace the trams by railless cars.

L.N.E. Railway.—ELECTRIFICATION SCHEME.—Details have just been made public of the London & North-Eastern Railway Company's scheme for the electrification of the Great Northern main line system from King's Cross to Edgware, High Barnet, Welwyn, and Hertford. The scheme has been placed before the Development Act Committee, and is dependent on assistance from public funds being granted. Should this assistance be forthcoming the company could complete the work of electrification within three years of its commencement. It is unlikely, however, even if the Development Act Committee decides favourably with regard to the scheme, that any final decision will be made to proceed with the work until the fate of the Underground Companies' Bill for the Finsbury Park tube extensions now before Parliament is decided, since it is estimated that the L.N.E.R. would suffer a loss of £110,000 annually if the tube extensions were carried out. The project includes the electrification of the main lines of the Great Northern system leading out of London *via* Hatfield and Enfield, as far as Welwyn Garden City and Hertford, 20 miles from King's Cross. The suburban branches leading from Finsbury Park to Alexandra Palace, High Barnet, and Edgware will also be electrified. The total length of line to be electrified is 60 miles of route, equal to 173 miles of single track. The cost is estimated at £3,700,000, to which must be added a further item of £650,000 for the widening of three tunnels between New Barnet and Potters Bar stations. In connection with the electrification scheme generally there will be a number of alterations to stations and sidings. The carrying out of the scheme will in some measure depend upon negotiations which are in hand with other railways with a view to arrangements being made for through electric trains to be run from the L.N.E.R. lines described above to Broad Street, to Moorgate Street *via* the Metropolitan Railway, and to Moorgate from Finsbury Park through the G.N. and City Tube. The third-rail d.c. system is to be adopted, and the power is to be obtained from existing supply companies and taken direct to 19 sub-stations. Approximately 165 miles of cable will be required. If the electrification is carried out the intention is to double the existing train service over the area served, and further intensification will be possible as the traffic develops. At present the company runs 1,945,000 train miles per annum in the area to be electrified, and when the electrification is complete the train mileage will be increased to 4,000,000 per annum. At the present time the L.N.E.R. carries 28,000,000 suburban passengers a year through Finsbury Park on their way to and from London.

Manchester.—TRAMWAY RECONSTRUCTION.—The Corporation Transport Committee has obtained sanction to a loan of £19,000 for the reconstruction of tramway lines in Heywood.

Newcastle-upon-Tyne.—TRAMWAY ABANDONMENT. — Representatives of the City Council recently waited upon the Minister of Transport to discuss the question of substituting omnibuses for trams on the service between Newcastle and Wallsend.

Rotherham.—REPLACEMENT OF TRACTION CABLES.—The Corporation Tramways Committee is to replace traction cables in Sheffield Road at a cost of £2,150.

Telegraph and Telephone Notes.

Irish Free State.—TELEPHONE SERVICE.—The Free State Department of Posts and Telegraphs announces that the "personal call" facility was introduced to the trunk service on April 1st.

Similar service is available from any place in Northern Ireland and Great Britain.

Photo-telegraphy.—EMPIRE RADIO SERVICE TESTS.—Facsimile photo-telegraphy by means of beam radio transmission to various parts of the Empire is entering the practical stage. According to *The Times*, apparatus has been sent to South Africa for installation at Kodak House, the headquarters of the South African Wireless Telegraph Co., to enable tests to be made between Cape Town and Radio House, London, the wireless headquarters of Imperial and International Communications, Ltd. In Anglo-Australian tests the ordinary beam system was not used. The Post Office allowed the use of certain directional apparatus at its Rugby station, and Amalgamated Wireless (Australia), Ltd., co-operated in the experiment. Anglo-American and Anglo-Continental services have been in operation for some time.

Radio-telephony.—ANGLO-AUSTRALIAN SERVICE.—The Australian Post Office is demanding a guarantee that the proposed wireless telephone service from Rugby shall be available at certain definite hours before accepting the British Government's plan. The Post Office is also asking that the fee for a three-minutes' conversation shall be £6 instead of £9 as at first proposed, and that of that sum the British Post Office shall take £3, the Australian Post Office 15s. and Amalgamated Wireless, Ltd., which will operate the service, £2 5s.—*Reuter's* (Sydney).

Rumania.—TELEPHONE MONOPOLY.—The Bucharest papers report that the Rumania telephone monopoly is to be leased to the Swedish Ericsson Co.

The Morgan group offered to lend 2,000,000,000 lei to the Government at a low rate of interest for a long term in return for the grant of a telephone concession for the whole of the country. The scheme provided for the establishment of telephone networks in all towns within three years and the substitution of modern for old apparatus, the expenditure on the work being estimated at from 6,000,000,000 to 7,000,000,000 lei. The undertaking connected with the Morgan group is stated to be the International Telephone and Telegraph Company, which, together with the Berlin A.E.G., controls the recently formed Standard Elektrizitäts Gesellschaft.

Ship-Shore Telephony.—CONTINENTAL SERVICE.—The ship-to-shore radio-telephony service now in operation between this country and the White Star Co.'s liners s.s. *Olympic* and s.s. *Majestic* has, the International Marine Radio Company, Limited, advises us, now been extended to France, Belgium, and Holland. Arrangements are also complete for the facilities to be further extended in the course of a few days to Germany, Switzerland, and Spain, immediately the approval of the respective Administrations is received. The same land line service is being employed as is used for the England-U.S.A. transatlantic service.

Spain.—RADIO-TELEPHONY.—A beam radio-telephone service has been opened to the public between Madrid and Rio de Janeiro, Brazil. The stations conducting the new service in Spain are of the short-wave beam type and were erected by Marconi's Wireless Telegraph Co. at Aranjuez, near Madrid. In addition to the telephone service, a commercial telegraph service is in operation. For use in these circuits special receivers have been constructed by the Marconi Co. on behalf of Transradio Espanola, the Spanish company to which the stations belong and which carries on the services between Spain and other countries. The South American end of the service is controlled by the Companhia Radiotelegraphica Brasileira.

Sweden.—TELEGRAPHS AND TELEPHONES.—The Swedish telegraph and telephone services, which are entirely Government-owned, report a net surplus of earnings for 1929 of Kr. 22,900,000, representing 7.3 per cent. on invested capital. In 1928 the net surplus was Kr. 20,090,000, or 6.6 per cent. on the capital then invested.—*Reuter's Trade Service* (Stockholm).

Transatlantic Cables.—REPAIRS COMPLETED.—The repairing of the many breakages of the transatlantic submarine telegraph cables caused last November by ocean-bed earthquakes was finally completed last week.

U.S.A.—EXPLOSION.—New York's telephone repair men had a busy night repairing the damage done to cables by violent subterranean explosions which took place in Broadway about noon on April 3rd. Thousands of telephones were put out of order by the explosions, and over 120,000 lines were out of commission, including ten thousand trunk lines, affecting practically every exchange in the city. Two important Western Union cables were disrupted, but have now been repaired.—*Reuter's* (New York).

RADIO-TELEPHONY.—A radio-telephone service was inaugurated on April 3rd between North and South America. The two-way circuit was established by the Compania Internacional de Radio (Argentina) and the American Telephone and Telegraph Company, more than 277,000 telephones in Argentina, Chile, and Uruguay being connected with 21,600,000 telephones in Mexico, Cuba, the United States, and Canada. The new circuit was thrown open for public use, not only from special telephone booths in cities where terminals exist, but also to and from any subscriber in the countries concerned. The terminals are located near Buenos Aires and New York, respectively. At the former point the transmitting station is at Hurlingham, adjacent to the Buenos Aires-Madrid transmitting station, while the receiving stations for both New York and Madrid are at Platanos. The new stations are similar to those used for the Buenos Aires-Madrid service, which was inaugurated on October 12th, 1929. The Hurlingham station is on a 200-acre site approximately twelve miles from Buenos Aires. There are seven steel towers, each 180 feet high, the tower line being almost a third of a mile long. The wires forming the three aerial systems, like a coarse curtain, hang vertically between the towers to within 3 feet of the ground. At the receiving station at Platanos the aerials are designed with a similar reflector effect. Land lines connect Santiago and Montevideo with Buenos Aires. From Santiago the lines cross the Andes Mountais, while at one point the Montevideo land lines go under the Rio de la Plata, one of the widest rivers in the world. The distance between the South and North American terminals is approximately 5,290 miles.

Radio Notes.

France.—Nice Station.—It is understood that a new transmitter is to be erected in a suburb of Nice, where the studio will be located; it is to have a power of at least 25 kW and is to be ready in four months' time to take the place of the Juan-les-Pins station.

Regional Wavelengths.—Re-allocation Probable.—When the projected regional stations have all been completed, it may be earlier, some re-allocation of wavelengths may become desirable. For instance, recognising that the 261.3-m. wave is more subject to local screening, "pockets" of varying signal strength, and greater attenuation than a longer one would be, the London national programme transmitter at Brookman's Park may eventually operate on the British exclusive wavelength of 288.5 m. The allotment of that wavelength to it at the outset would, says *World-Radio*, have involved greater dislocation and serious expense, as it is at present shared in common by the British relay stations driven on the tuning-fork system.

Licences.—Distribution.—It is estimated that there are approximately one million licence holders in the service area of the Brookman's Park station. The Post Office has for the first time provided the B.B.C. with a list that indicates the distribution of licence holders about the country. According to the *Wireless World*, it shows that the whole of Scotland contains only 195,000 licensees, compared with 541,000 in the London postal district alone. In the provinces, Lancashire, with 304,000, is well ahead of its nearest rival, Yorkshire, which boasts a quarter of a million. Wales contains a fifth of London's figure, and Northern Ireland has only 30,000. Surrey, Middlesex, and Kent are assisted by London's overflow, but counties without powerful local stations, such as Northumberland, Herefordshire, Norfolk, and Suffolk, do not apparently contain many licence holders. Rutland has just over a thousand licensees.

Other figures are: Bedfordshire, 20,644; Cornwall, 14,638; Hampshire, 81,940; Hertfordshire, 42,723; Lincolnshire, 47,296; Oxfordshire, 24,770; Staffordshire, 63,884; Surrey, 106,649; Glamorganshire, 57,195.

United States.—High-power Station.—Planned by the General Electric Co. of America some years ago, the new WGY broadcaster in the Mohawk Valley on the outskirts of Schenectady, New York State, now transmits with a power of 200 kW; its wavelength is 380 metres, call sign W2XAG, and it has been logged at distances of 10,000 miles with clarity. Nearly four years ago the station's power was raised to 50 kW; two years ago it was 100 kW, and in January last 150 kW. The most powerful European stations use only 60 kW. According to the *Daily Express*, the bold experiment was made of constructing six 100-kW power valves and using them in pairs; each is 5 ft. long and, including its cooling water jacket, occupies a space of 7.5 ft. Piezo-electric crystal control is utilised.

Contract Information.

When "Contracts Open" are advertised in our "Official Notice" pages, the date of the Electrical Review containing the advertisement is given in parentheses below.

Contracts Open.

Australia.—Melbourne.—May 5th. State Electricity Commission of Victoria. Supply of 22,000-V current limiting reactors. (B.X. 6226.)*

May 12th. Supply of 22,000-V pin-type supporting insulators for 12 months. (B.X. 6179.)*

May 20th. Posts and Telegraph Department. Terminal strips. (B.X. 6247.)* Telegraph instruments. (B.X. 6248.)*

Bedford.—May 5th. Electricity Department. Supply, delivery and erection of 11,000-V overhead lines and auxiliary apparatus (other than transformers) required for supplying an area of 100 sq. miles. (April 4th.)

Belgium.—Antwerp.—April 28th. Municipal Council. Cables and joint boxes. (B.X. 6312.)*

Bexhill.—April 22nd. Electricity Department. Laying and jointing of approximately 1,600 yd. of 0.05 sq. in. three-phase 11,000-V cable. (March 14th.)

Cheadle and Gatley.—May 6th. Electricity Department. Supply, delivery, and erection of an induction voltage regulator. (See this issue.)

Dartford.—April 26th. Urban District Council. Supply of 785 yd. of e.h.p., l.c. and armoured cable, and 640 yd. of l.p., l.c., and armoured cable. (See this issue.)

Dundee.—May 10th. Electricity Department. Two electrically-driven circulating water pumps. (April 4th.)

April 23rd. Transport Department. Twelve months' supply of materials, including armature and field coils, &c. Specifications from general manager.

April 22nd. Education Authority. Central heating and electric lighting installations for the new Central School at Rockwell. Specifications, Allan & Friskin, architects, 26, Castle Street, Dundee.

Edinburgh.—April 14th. Education Authority. Electrical and heating installations at new primary school, Wardie. Specifications from J. M. Johnston, architect, 47, Charlotte Street, Leith.

Egypt.—Cairo.—May 17th. Director-General, Main Drainage Department, No. 2, Sharia Maleka Nazli. Supply of electrical articles and lamps required during 1930-1931.—*Reuter's Trade Service* (Cairo).

Fife.—April 16th. Education Authority. Electrical work at additions to Ward Academy, Anstruther, and the new school, Kirkcaldy. Schedules (deposit one guinea) from G. Sandilands, architect and master of works, Education Offices, Kirkcaldy.

Hastings.—April 14th. Corporation. Supply, delivery, erection and setting to work in White Rock Pavilion one 2-gallon capacity ice cream freezer, and cold storage cabinet. (April 4th.)

Ilford.—April 28th. Electricity Department. Supply, delivery, and erection of converting plant of 500-kW capacity. (See this issue.)

London.—Central Electricity Board.—April 16th. Construction of site works and foundation works for the transformer stations at Ribble (Preston) and Lancaster. (March 28th.)

April 28th. Supply of 22-kV, 11-kV, and 66-kV switchgear for the North-West England and North Wales Electricity Scheme, 1928. (April 4th.)

May 5th. Supply, delivery, and erection of 33-kV transmission line crossing of the river Witham, Boston. (April 4th.)

May 12th. Supply, delivery, and erection of 66-kV and lower voltage transmission lines, and switchgear for the Mid-East England Electricity Scheme, 1929. (April 4th.)

London County Council.—April 14th. Supply and delivery of h.p. and l.p. cables and reconstruction of existing l.p. cables. (March 21st.)

Commissioners of H.M. Works.—April 22nd. Supply of incandescent electric lamps. (See this issue.)

Manchester.—April 14th. Electricity Committee. Supply and delivery for 12 months of meters, transformers, cables, time switches, auto-transformers, and auto-balancers, a.c. motors, and kettles. (April 4th.)

Twelve months' supply of dry batteries, box compound conduit, wiring accessories, service boxes, cotton and silk-covered wire, &c. Forms of tender from Mr. H. C. Lamb, chief engineer and manager, Electricity Department.

Newtownards (Co. Down).—April 26th. Board of Guardians. Electrical plant and wiring for the New District Hospital. Specifications (£2 2s.) from the Clerk to the Union, Newtownards (Co. Down).

New Zealand.—Wellington.—May 6th. Public Works Department. 750-kVA transformers for Arapuni power scheme. (B.X. 6095.)*

May 13th. 110-kV transformers for Mangahao power scheme. (B.X. 6096.)*

May 27th. Supply of 110-kV suspension insulators for the Waitaki power scheme. (B.X. 6216.)* 110-kV suspension insulators for the Mangahao power scheme. (B.X. 6300.)*

June 24th. Outdoor steelwork and 110-kV switchgear for the Waitaki power scheme. (B.X. 6238.)*
May 20th. One 25-kVA, 3-phase, 400/230-V generator. (B.X. 6307.)*
May 13th. Posts and Telegraph Department. Terminal strips. (B.X. 6209.)*
June 25th. Condensers. (B.X. 6308.)*

South Africa.—CAPETOWN.—May 7th. Electricity Department. L.p. ironclad switchgear. (B.X. 6293.)*

* Further particulars can be obtained at the Department of Overseas Trade (Inquiry Room), 35, Old Queen Street, S.W.

Contracts Closed.

Barrow.—Town Council. Accepted :—
Four 25-kVA 11,000-V transformers (£170).—Johnson and Phillips, Ltd.
Three sets switchgear for Cark, Pennington, and Kirby Slate Quarries (£525).—Metropolitan-Vickers Electrical Co., Ltd.
12 months' supply of the following stores :—
T.p. switch cut-outs, d.p. ironclad switches and cut-outs, lamps, light cables, electric irons and kettles, &c. —W. R. Thornton, Ltd.
Tinned copper wire.—T. Bolton & Sons, Ltd.
Tapes, e.h.p. compound, 30-A d.p. switches, cut-outs, underground cables, &c.—British Insulated Cables, Ltd.
Insulating compound.—Dussek Bitumen Co., Ltd.
Electric meters.—Ferranti, Ltd.; Landis & Gyr, Ltd.
Electric cookers.—Credenda Conduits Co., Ltd.

Belgium.—Belgian, German, British (Callender's Cable and Construction Co., Ltd.), French and Dutch firms submitted tenders on March 28th to the municipal authorities of Schaerbeek, Brussels, for the supply of 6,500 metres of l.p. and 4,800 metres of h.p. armoured cable. The quotations ranged from £4,113 to £4,621, the lowest being that of the Société de la Manufacture de Câbles Electriques et de Caoutchouc, Eupen, Belgium.

Blackburn.—Electricity Committee. Accepted. Materials for 12 months :—
6,000-V cables.—Edison Swan Cables, Ltd.
660-V cables.—Derby Cables, Ltd.
V.i.r. wires and cables.—Mersey Cable Works, Ltd.
Flexibles.—Siemens Bros. & Co., Ltd.
Consumers' meters.—Ferranti, Ltd.
Electric lamps.—General Electric Co., Ltd., and British Thomson-Houston Co., Ltd.

Bradford.—Electricity Committee. Accepted :—
Air compressor for Valley Road power station (£1,050).—Peter Brotherhood, Ltd.
One-ton tone hand-operated crane.—Vaughan Crane Co., Ltd.
H.p. steam piping.—Aiton & Co., Ltd.
Feed pump delivery piping.—J. Spencer, Ltd.
Tramways Committee.—
30 drums of copper trolley wire (£1,403).—Thos. Bolton and Son, Ltd. (per Cocker Bros.).

Central Electricity Board.—Accepted :—
Overhead transmission lines in connection with the North-West England and North Wales Electricity Scheme, 1928.—Enfield Cable Works, Ltd.
Overhead transmission lines in connection with the South-East England Electricity Scheme, 1927.—Watsahams, Ltd., and W. T. Henley's Telegraph Works Co., Ltd.
The approximate total value of the contracts is £320,000.

Colchester.—Electricity Committee. Recommended :—
140-kW motor-generator (£220).—F. S. Slater & Co.
18-kW motor-generator (£95).—Crompton Parkinson, Ltd.

Dumfries.—Town Council. Accepted :—
Piping, jointing materials, &c., in connection with the circulating-water piping and valves for the new cooling tower (£500).—Worthington-Simpson, Ltd.
Cast-iron valves.—Glenfield & Kennedy, Ltd.

Eastbourne.—Electricity Committee. Accepted :—
L.p. lines (£2,646), revised.—W. T. Henley's Telegraph Works Co., Ltd.

Glasgow.—Municipal Transport Committee. Recommended :—
Copper trolley wire.—Thomas Bolton & Sons, Ltd., and F. Smith & Co., Ltd.
Suction plant for depôts.—Sturtevant Engineering Co., Ltd., and Metropolitan-Vickers Electrical Co., Ltd.
Electro-magnet crack detector.—W. C. Yuille & Co., Ltd.
Electricity Committee. Accepted. Plant and appliances in connection with the change of frequency :—
Motors, &c.—General Electric Co., Ltd. (£1,571),; Harland Engineering Co., Ltd. (£7,112); J. Grieve & Co. (£350); English Electric Co., Ltd. (£224); Brook Motors, Ltd. (£115); A.S.E.A. Electric, Ltd. (£139); Metropolitan-Vickers Electrical Co., Ltd. (£1,456); J. Bennie, Ltd. (£317); T. Harding Churton & Co. (£204); W. McGee & Co. (£414); Lancashire Dynamo and Motor Co., Ltd. (£781) British Thomson-Houston Co., Ltd. (£2,438).

Ilkley.—Bradford Corporation Health Department. Accepted :—
Installation of electric light at Semon Convalescent Home (£244).—Armitage & Longbottom.

Irish Free State.—DUBLIN.—Local Government and Public Health Department.
12 months' supply of Siemens electric lamps and batteries. —Siemens Electric Lamps & Supplies, Ltd.

Leeds.—Electricity Committee. Accepted :—
Cables (£1,441), W. T. Henley's Telegraph Works Co., Ltd.; (£2,461), Enfield Cable Works, Ltd.; (£4,557), Macintosh Cable Co., Ltd.; (£2,683), Croydon Cable Works, Ltd.

Liverpool.—City Council. Recommended :—
Vacuum dust and soot collecting plant (£318).—British Vacuum Cleaner & Engineering Co., Ltd.

London.—LONDON & NORTH-EASTERN RAILWAY CO.—
12 months' supply of " Mazda " lamps.—British Thomson-Houston Co., Ltd.

Manchester.—Education Committee. Accepted :—
Electric lighting, St. Phillips School.—A. Loudon.
Electricity Committee. Accepted :—
Steelwork for boiler installation at Barton station.—Widnes Foundry, Ltd.
Two 750-kVA transformers.—C. A. Parsons & Co., Ltd.

Plymouth.—Electricity Committee. Recommended :—
Cables (revised recommendation). — British Insulated Cables, Ltd., Derby Cables, Ltd., and Metropolitan Cable Co., Ltd.

Rotherham.—Electricity Committee. Recommended :—
Transformers for twelve months.—Crompton Parkinson, Ltd.
Switchgear for twelve months.—A. Reyrolle & Co., Ltd.
Education Committee. Recommended :—
Electric light installation at Cranworth school (£745).—Messrs. Ibbotson Bros. (Rotherham), Ltd.; at new Technical College (£6,830).—Dean's Electrical & Engineering Co., Ltd.

Sheffield.—Tramways Committee. Accepted :—
30 tramcar controllers.—British Thomson-Houston Co., Ltd.
800 tons tramway rails (£7,963).—Cargo Fleet Iron Co., Ltd.
2,200 copper bonds (£244).—British Insulated Cables, Ltd.

Smethwick.—Education Committee. Recommended :—
Electric heating system at Uplands school (£3,856).—Young, Osmond & Young, Ltd.

Torquay.—Electricity Department. Accepted :—
One 7,500-kW turbo-alternator, &c. (£26,595).—British Thomson-Houston Co., Ltd. (12 tenders were received).

Wimbledon.—Electricity Committee. Accepted :—
Alterations and additions to 10,000-V and 2,000-V switchboards (£2,197 and £1,088, respectively).—A. Reyrolle & Co., Ltd.
Replacement of existing .15 11,000-V main to Raynes Park by .25 11,000-V ditto (£3,809).—Siemens Bros. and Co., Ltd.

Forthcoming Events.

Physical Society.—Friday, April 11th. Imperial College of Science, South Kensington, S.W. 5 p.m. Ordinary meeting.

Association of Mining Electrical Engineers.—Saturday, April 12th. South Wales Institute of Engineers, Cardiff. 6 p.m. " Some Considerations Governing Power Costs at Collieries." Mr. S. T. Richards.

Institution of Electrical Engineers.—Informal meeting. Monday, April 14th. Institution, Savoy Place, W.C. 7 p.m. Discussion on Telephone Exchange Practice in Germany and Scandinavia, to be opened by Mr. A. B. Eason.

(Irish Centre).—Thursday, April 17th. Trinity College, Dublin. 7.45 p.m. Ordinary meeting.

Institution of Electrical Engineers—(*continued*).

(Mersey and North Wales (Liverpool) Centre).—Monday, April 14th. University, Liverpool. 7 p.m. Annual general meeting.

(North-Eastern Centre).—Monday, April 14th. Armstrong College, Newcastle-on-Tyne. 7 p.m. Annual general meeting.

(North-Eastern Students' Section).—Friday, April 11th. Carliol House, Newcastle-upon-Tyne. 7.15 p.m. Annual general meeting.

(North-Midland Centre).—Tuesday, April 15th. Hotel Metropole, Leeds. 7 p.m. Annual general meeting.

(South-Midland Centre).—Monday, April 14th. University, Birmingham. 7 p.m. Billingham Steam and Electric Power Plant. H. A. Humphrey, D. M. Buist, and J. W. Bansall.

(Western Centre).—Monday, April 14th. Town Hall, Cheltenham. "The Heating of Buildings Electrically by means of Thermal Storage." Lt.-Col. S. E. Monkhouse and Mr. L. C. Grant.

(Hampshire Sub-Centre).—Thursday, April 17th. Municipal College, Portsmouth. 7.30 p.m. "A.c. Potentiometers and their applications." Dr. C. V. Drysdale.

(Sheffield Sub-Centre).—Wednesday, April 16th. Royal Victoria Hotel, Sheffield. 7.30 p.m. "The Selection of Electric Drive for Heavy Industrial Use." Mr. H. S. Carnegie.

Association of Supervising Electrical Engineers.—Tuesday, April 15th. Junior Institution of Engineers, 39, Victoria Street, S.W. 7.15 p.m. "Present-day Practice in Overhead Line Construction." Mr. J. R. Harding.

The "Electrical Review" Service Department.

Inquiries must be accompanied by a stamped addressed envelope.

We shall be glad to learn the names and addresses of makers of the following devices:—

Boxon Eclipse vacuum cleaners.

Halo signs having hollow metal letters with illuminated background.

Strip copper having imitation hammered finish as used in electric fires.

Notes.

The Institution of Engineers-in-Charge.

The thirtieth annual dinner of the Institution of Engineers-in-Charge was held in the Throne Room of the Holborn Restaurant, London, on April 4th. Mr. H. G. Burford, M.I.Mech.E., president of the Institution, took the chair, and about 275 members and guests were present.

After the loyal toasts had been honoured, Mr. A. E. L. Chorlton, C.B.E. (vice-president, I.Mech.E.), proposed the toast of the Institution. He expressed the fear that the class of practical engineers, on whose work the industrial position and trade connection of the country was based, might be lost to the country. It was the duty of the younger men to devise some means of securing the same kind of recognition for engineers as was obtained for other professions; to that end combination was essential. The record of the Institution and the quality of the papers discussed before it indicated its high standard. He referred to the proposed scheme for creating a central headquarters in Westminster for several societies with common libraries as an instance of progress in co-operation between scientific bodies.

The president, in responding, said that the raising of the status of engineers through co-operation had always been one of his great interests in life. The Institution was in a very healthy position, financially, in growth of membership, and in the quality of papers read. He paid notable tribute to the enthusiasm and activity of the hon. secretary, Capt. E. E. Penn.

The toast of "Engineering and its Application to Health and Progress," was proposed by Sir Henry P. Maybury, G.B.E., K.C.M.G., C.B., who compared the engineer, in his single minded attention to duty, to the man who, while bathing, had his clothes stolen. Engineers should take a lesson in organisation from the British Medical Association.

Mr. E. A. Sandford-Fawcett, C.B. (vice-president of the Institution), in reply, said that he had more respect for the man who could make things work than he had even for the designer.

"Our Guests and Friends" was proposed by Mr. Asa Binns, M.Inst.C.E., to which Col. Sir Arthur Holbrook, K.B.E., M.P., responded.

The health of the president was proposed by Mr. G. A. Hughes, A.M.I.Mech.E. (chairman of the Institution).

The president, in responding, said that the time had come when they must consider the appointment of a full-time secretary.

During dinner and between the speeches an orchestral and vocal programme was enjoyed.

The International Electrotechnical Commission.

The British National Committee of the International Electrotechnical Commission, *i.e.*, the Electrical Industry Committee of the British Engineering Standards Association, is now actively engaged in preparations for the British participation in the forthcoming important meetings of the Commission. The technical meetings will be held in Stockholm during the first week in July, after an opening meeting in Copenhagen, and the closing plenary session, together with a meeting of Council, will take place in Oslo. There will be meetings of 15 Advisory Committees dealing with the following subjects: nomenclature; rating of electrical machinery; symbols; steam turbines; aluminium; voltages, including tests on high-voltage insulators; electric traction equipment; insulating oils; overhead lines; radio valves; measuring instruments; rating of rivers; tests for shellac; rating of oil switches; and internal combustion engines.

A very influential delegation, consisting of representatives of government departments, the Institution of Electrical Engineers, the Institution of Civil Engineers, the Electricity Commissioners, the Central Electricity Board, and manufacturing, research, and supply organisations interested in the work of international standardisation in the electrical field, will be present from Great Britain, and delegates from the Dominions will also be present. The Scandinavian National Committee of the I.E.C. is making arrangements for the visiting delegates to see some up-to-date hydro-electric and other plant, while for those who care to stay after the meetings, an interesting trip to view the "Midnight Sun" is being organised.

Electron Affinities of the Elements.

A method is outlined in *Nature* which enables one to say approximately which elements have a positive electron affinity, and also to predict the approximate position of whatever lines of the electron affinity spectrum occur. By definition, the electron affinity of an atom is the ionisation potential of its negative ion, or the difference in energy between the normal state of the atom and the normal state of the ion. From the work of Bowen and Millikan and others on stripped atoms many of the higher ionisation potentials are known. In the iso-electronic sequence Be++, Li+, He, H−, the ionisation potentials of the first three are known, and so we may extrapolate to get that of the fourth. This would be one method of estimating the electron affinity of the hydrogen atom. In this case, one must make a long extrapolation (from 24.47 volts), and so the attainable accuracy is not extremely high. Assuming that the square root of the ionisation potential is linear in Z, the atomic number, which gives reasonable agreement with the experimental values, one finds the electron affinity of H to be 1.4 volts. Other methods of extrapolation may yield somewhat lower values. This is in agreement with theoretical work of Bethe (*Zeits. f. Phys.*, 57, 815; 1929), who concluded that the electron affinity was greater than 0.75 volt.

If we examine the first row of the periodic table, then it seems almost necessarily to follow from any reasonable extrapolation that the electron affinity will show the following behaviour. For helium, it will be negative, indicating that H− is not stable. For lithium, it will be greater, perhaps positive, to decrease again with beryllium, increasing to carbon, decreasing to nitrogen, and increasing to fluorine, where the value is about 3.5 volts. The second row shows a similar behaviour, the increases in both cases being linear. The first excited states of H−, 2^1S and 2^3S lie close below the normal state of H, and the states 2^1P and 2^3P both lie above, tending to show that no discrete electron affinity spectrum for H− is possible, as Bethe also concluded.

If we consider the iso-electronic sequence Ca++, K+, A, Cl−, using data from I. S. Bowen (*Phys. Rev.*, 31, 457, 1919) and from K. W. Meissner (*Zeits. f. Phys.*, 40, 839, 1929), then assuming the second differences to be approximately constant, one obtains 3 volts for the electron affinity of chlorine, but the first excited state of Cl− lies above the normal state of the chlorine atom, so one would likewise expect no discrete electron affinity spectrum there. A systematic investigation may possibly reveal elements which possess such a spectrum.

A Large Pumping Plant.

Construction of the largest single pumping station in the world will, according to *Power*, soon be started by the City of Detroit, Mich., U.S.A., to meet that city's increasing demand for water, and is expected to be in operation in 1932. The centrifugal pumps that will raise water from the large well are low-shift; six will be of 750 h.p., and two of 350 h.p. The 750-h.p. pumps will be driven by synchronous motors, and the smaller pumps by slip-ring induction motors. The 12 horizontal centrifugal pumps, which will take the water from the filter plant and pump it into the mains, are high-lift; eight of them will be driven by synchronous motors and four by slip-ring variable speed induction motors. A special power station has been designed for an ultimate capacity of 30,000 kW.

Diversity Factors in Industry.

The report of the Census of Manufacturers in the U.S.A. for 1927 contains statistics of the generator capacity of manufacturing establishments operating their own power plant, and of the aggregate rating of motors driven by energy generated therein.

The ratio of motor horse-power to generator rating is high in the groups involving metal-working machinery, where the operations are discontinuous and the loads unsteady; it is low in textile, chemical, and leather industries, where loads are generally fairly steady.

The effect of the lighting load is to cause the motor horse-power per unit of generator capacity to be smaller in the "light" industries than in the so-called "heavy" ones.

Industry Groups.	Generators kW.	Motors H.p.	Motor h.p. per 100 kW gen.
Food and kindred products ...	474,371	632,279	135
Textiles and their products ...	1,005,723	1,055,750	105
Lumber and allied products ...	611,817	829,405	136
Paper and paper products	716,230	990,050	138
Printing, publishing, and allied industries	25,043	31,783	127
Chemicals and allied products ...	380,681	429,234	112
Products of petroleum and coal	288,752	502,169	174
Rubber products	165,618	206,362	125
Leather and its manufactures ...	114,978	134,103	117
Stone, clay and glass products ...	523,481	730,171	140
Iron and steel and their products, excluding machinery	1,688,703	3,605,699	214
Non-ferrous metals and their products	232,847	298,712	129
Machinery, excluding transport equipment	502,631	865,413	172
Transport equipment, air, land and water	351,015	473,944	135
Railroad repair shops	172,310	264,289	153
Miscellaneous	111,485	157,616	142
All industries, total	7,366,535	11,206,979	152

Values of Illumination.

In a paper read before the American I.E.E. (New York Section) the requirements in artificial light of the average family are laid down.

The following values in foot-candles were submitted as representing existing and best conditions:—

	Activities requiring— Work Illumination.	Social Illumination.	Utility Illumination.
A. Minimum present good practice	15	5	3
B. Minimum recommended	30	10	5
C. Probable levels of greatest economic advantage	50	15	5
D. Possible desirable levels from eye-considerations only	300	50	30

In this table "work illumination" means reading, writing, sewing, factory work, &c.; "social illumination" the home, places of public assembly, &c.; and "utility illumination" passages, store rooms, streets, &c.

The potential consumption of electricity in the U.S.A., based on eye-considerations only (*D*) was estimated at 778,900 million kWh per annum, as against an actual consumption for this purpose in 1929 of some 20 million kWh.

The Tokio Congress.

At yesterday's informal monthly luncheon meeting of the British Engineers' Association held at St. Ermins Restaurant, Westminster, Mr. Richard W. Allen, C.B.E., spoke on "The World Engineering Congress, Tokio, Japan."

Electricity Meters in New York.

Of the 2,188,121 meters on the lines of the New York Edison Company, Brooklyn Edison Company, United Electric Light and Power Company, New York, and Queens Electric Light and Power Company, and the Yonkers Electric Light and Power Company, 310,017 were tested in 1929 and only 694 were found to be operating fast, or to the disadvantage of the consumers. A total of 302,231 was operating accurately according to prescribed legal standards, and 7,019 were slow, or registering to the disadvantage of the companies. Of the total of 2,188,121 consumers, only 393 complained directly to the Public Service Commission that they thought their meters were inaccurate. The tests showed that only two were registering fast, or to the disadvantage of the consumers, 13 were slow, or to the disadvantage of the companies, and 378 were operating accurately according to the prescribed legal standards. In addition to the 393 complaints made to the Public Service Commission, 12,603 consumers complained directly to the companies. The tests showed that only 84 of those 12,603 meters were recording faster than the legal standard, or against the consumer; that 418 were recording slow, or to the disadvantage of the companies; and that 12,101 were registering correctly. The above figures do not apply to meters in buildings where sub-metering is practised, as the companies and the Public Service Commission do not have control over such meters. The gain in number of meters on the New York Edison system in 1929 was 68,485. The greatest gain was in Brooklyn, with 23,619; in Queens the increase was 20,550; in Yonkers, 2,921; and in Manhattan and Bronx, 21,395. The increase in meters is not an accurate index to growth in congested areas like Manhattan, where several six-storey buildings containing a number of meters may be replaced by a skyscraper with fewer meters but greatly increased consumption of electricity. Many new buildings use from ten to twenty times the electricity their predecessors on the same sites used.

Magnetisation Curve of Iron Crystals.

A correspondent in *Nature* draws attention to the varying results of investigations made by independent observers into the magnetisation of single iron crystals. It is suggested that such differences are ascribable mainly to the unsatisfactory accuracy with which magnetic field intensity has been estimated when the demagnetisation factor is very large, or when it is a function of the magnetisation, as it is in specimens that are not ellipsoids. In the latter case, the only way in which the field intensity can be determined is by direct measurement, which experimenters have seldom employed, preferring rather to rely on calculation of the demagnetising component of the field intensity by methods which have been shown to rest on invalid assumptions.

The outstanding problem evoked by these discrepant observations is the question of whether or not there are "breaks" (abrupt changes of slope) in the magnetisation curves and hysteresis loops. It is submitted that the breaks appearing in these curves are due to incorrect estimation of the field intensities. In support of this idea the following facts are offered:—

When a sufficient number of points on the curve are obtained and the *actual* magnetising field—the applied field less the demagnetising component—is *measured* with considerable accuracy, the magnetisation curve has no breaks. If, however, the same data are plotted *without* applying the measured field-intensity corrections, curves are obtained which in most cases are so flattened at the knee that it is possible to construct that portion of the curve with one or two sharp changes of slope. The reason for this is that the demagnetising component of the field intensity usually goes through a rather sharp maximum in the same range of magnetisation as is occupied by the knee of the curve. This maximum is always present in uniform cylinders. In iron crystals the curve of demagnetising component *v.* magnetisation, or "correction curve," is unlike that for ordinary iron, and is similar in shape to that obtained in polycrystalline permalloy. In no case is this correction curve the familiar straight line ("shearing curve") which has been so generally assumed.

The Electrical Association for Women.

The annual general meeting of the North-East Coast Branch of the E.A.W., which was held on March 28th, was in every way a success. There were 142 persons seated at the following luncheon, the speakers at which included Mr. D. Maxwell Buist, Mr. R. P. Sloan, and Miss C. Haslett, director, E.A.W.

The fifth annual Conference of the Association will be held in London on May 15th and 16th next. The following are the features of the programme: May 15th, luncheon at Park Lane Hotel at 1 p.m., visit to Home Office Industrial Museum at 3.30 p.m., talk by Mr. Ll. B. Atkinson on "Some Electrical Reminiscences," at the Institution of Electrical Engineers, during the evening; May 16th, visit to factory of Messrs. J. Lyons & Co., Ltd., at Greenford, at 10.30 a.m.; ball at Park Lane Hotel at 9 p.m.

The Manchester Steam Users' Association.

The annual report of the committee of management for the year ended December 31st, 1929, showed a revenue of £39,531 for the year, and an expenditure of £42,074. The number of members on the Association's books at the end of the year was 1,566, the number of works 4,383, and the number of boilers 11,132. During the year 21,103 examinations were made, 10,796 of which were of the classes known as "internal," "flue," and "entire."

Appointments Vacant.

General foreman of the Electricity Department for Malvern Urban District Council.

Draughtsman for Heston and Isleworth Urban District Council Electricity Department.

Engineer and manager for Dunoon and District Electricity Supply Co., Ltd.

Meter testers for the Shropshire, Worcestershire, and Staffordshire Electric Power Co.

Two steam engineers for Bradford City Electricity Department.

Two installation inspectors for Southend Corporation Electricity Department.

Technical assistant for the Ordnance Factories, Royal Arsenal, Woolwich, S.E. (See our advertisement pages today.)

A Large High-pressure Steam Engine.

At a recent meeting of the Philadelphia section of the A.S.M.E. it was stated that for the Philip Carey Co.'s new plant considerable power from a relatively small steam flow would be necessary, if all the electricity required were to be obtained as a by-product of process steam. About 6,000 kW is required with a steam flow of 120,000 lb. per hour. This steam is used at 45-lb. per sq. in. in the drying rolls of paper machines and for heating asphalt buildings, &c.

Thus the prime mover had to have a steam rate of not over 20 lb. per kWh, but the best that was offered by American turbine manufacturers was a steam rate of 21 lb. per kWh.

By using steam at 800 deg., an engine having the required economy could be obtained in Germany, but the physical dimensions became too large for construction. By increasing the steam pressure to 1,800 lb. per sq. in., dimensions were sufficiently decreased to make design feasible. Exhausting at 60-lb. back-pressure, the steam consumption of the engine is expected to be considerably below the required 20 lb.; at 1,425-lb. minimum initial pressure the engine will develop 5,400 h.p.

The engine consists of two single-acting high-pressure cylinders, two single-acting intermediate-pressure cylinders and one double-acting low-pressure cylinder. All of the cylinders are vertical. The single-acting high- and intermediate-pressure cylinders are in tandem, which eliminates high-pressure piston-rod stuffing boxes.

The five cylinders were all cast separately. The two high-pressure cylinders are 14 in. in diameter, the intermediates are 25 in. and the low-pressure is 33 in. diameter. The stroke is 25 in., and the speed 225 r.p.m.

Piston-type double-ported valves are employed, operated by double eccentrics. No valve stem packing is used, close fit and lubrication being depended upon to prevent steam leakage.

Cylinders are supported on cast steel *A* frames, and cylinders and frames are fastened to the engine base by through bolts. The crosshead-bearing surfaces are not cast integrally with the *A* frames, but are bolted to them. Glass doors in the frames and inside electric lamps permit observation of cranks and connecting rods.

Main shaft bearings are 14½ in. in diameter. The babbitt of these bearings is reinforced with steel plates to prevent its being pressed out at the ends. Oil is used for cooling the bearings and also the crosshead bearing.

It is not expected that cylinder lubrication will be necessary, but flake graphite can be used and subsequently recovered from the feed water.

Steam will be generated in water-tube cross-drum boilers. The drums are of forged steel 40 in. in diameter, and the walls are 5 in. thick. Before entering the low-pressure cylinders the steam is returned to reheaters, which raise the temperature to 525 deg. The boilers will be fired with pulverised coal from unit mills. Burners will be located at the four corners of the boiler and directed tangentially to the centre of the furnace.

An Electrical Demonstration Farm.

Reuter's Trade Service says that one feature of the agricultural show which is to be held at Stockholm this year will be a demonstration farm in which electricity will be utilised in all possible ways for simplifying and economising the work of the farm. The demonstration farm will not only be equipped with modern electrical plant and electrically-driven machines; a selection will also be shown of all other machines and implements used on a farm of this size.

A New Candle-power Standard.

The United States Bureau of Standards has devised a new method of measuring the intensity of light by means of pure platinum at its fusing point. The new method will, according to the *Electrical World*, supplant the comparison with the "international candle," a group of 46 lamps, set up in 1907 at the bureau as the standard. They were divided into eight groups and each lamp given a candle-power rating. All the lamps in each group had the same voltage-rating, though there were three different voltages in the entire group. One lamp was broken, and the 45 remaining showed on successive occasions variations in the amount of illumination produced, despite the fact that they have not been burned more than twenty hours in nearly a quarter century.

In contrast to these standards, that supplied by the molten platinum method has the great virtue of being reproduceable exactly at any time, the only requisite being pure platinum. In its pure state the metal always will fuse at 3,220 deg. F. In the experiment which established the new standard the platinum was chemically pure to within four parts in 1,000,000. Under ordinary circumstances, purity to within one part in 10,000 is considered highly satisfactory.

Another important step in the experiment which had been taken at an earlier date, was the perfection of a suitable crucible in which to melt the platinum. It had to be fashioned from a material that would withstand a temperature of 3,220 deg. F., and at the same time in no wise contaminate the metal within it.

The brilliance of the molten platinum is observed during the ten minutes elapsing just before it returns to the solid state. By means of photometric comparison the light emitted by the molten platinum is compared with the lamp standards.

Rural Electrification.

"The Economics of Rural Electricity Supply for Domestic Purposes" was the subject of a recent lecture by Miss Margaret M. Partridge, B.Sc., A.M.I.E.E., at a meeting of the Western Centre of the Institution of Electrical Engineers at the University College of the South-West at Exeter. Co-ordination, amalgamation, and co-operation were the watchwords of progress, but the "plums" had all been taken and so had the "currants." Unless their possessors were prepared to eat the "suety pudding" it was in danger of being wasted. Practically all the "plums" (the cities and big towns) had been taken by the municipalities; so had a good number of the larger "currants," and one would therefore naturally look to the municipal authorities to extend their supplies to neighbouring rural areas, but there was little to tempt them to do so. A municipal engineer dare not run a part of his undertaking at a loss and he might not, in effect, run it at a profit under the 1926 Electricity (Supply) Act. Ratepayers had but little interest in their neighbours, so all the tendency of a borough electricity undertaking was to confine its area of supply within the borough boundary, to the serious detriment of the rural district around; the exceptions were cases in which the rural districts were residential suburbs of the towns. Some public services, such as those conducted by the Post Office, had adopted the general principle of averaging costs and spreading them over the public, irrespective of the actual cost of the individual service rendered, but at present it was well to accept the principle of self-supporting consumers and examine the possibilities of the universal electrification of the country in the light of that policy. Miss Partridge said she had tried to evolve a general formula which would reveal at once the exact circumstances of density of population, or propinquity to an industrial load, which would, under present conditions, make any consumer, or group of consumers, an economic proposition. She had reached no finality in her investigations, because one item of data was missing, but she had collected a miscellany of quite illuminating facts and figures. The vital figure she could not discover was the saturation point of the purely domestic load. She once heard Sir John Snell say that the consumption of electricity in an all-electric house amounted to 1,300 kWh per inhabitant. If they could sell 1,300 kWh per head in a village for 1d. per kWh, or even less, there would be no economic problem at all connected with rural electricity supply, except, perhaps, the problem of securing enough copper, and they could go straight ahead and connect up every inhabited house in Great Britain. However, that Utopia was not yet, though probably many of them would live to see it. If electricity could be bought in bulk at an average of 0.5d. per kWh, it would be possible to give supplies for a capital expenditure of from £4 5s. to £4 10s. per head. Under the Central Board's south-western area scheme she thought that their purchasing costs would in the future average 0.5d. per kWh, and on that basis they would have to charge more than 0.5d. to the consumer to pay for the cost of distribution. She contended that it was a fallacy and an injustice to charge for electricity on the kWh basis, because actual costs per kW varied. She urged the engineer "when in doubt keep prices low in order to get a large demand and a fair return on capital," and to the consumer to "use electricity for all purposes in order to obtain it cheaply."

In opening the discussion, Mr. W. J. Bache (Cheltenham) thought the suggestion that comparatively few municipal undertakings had the vision to extend into rural areas might have been endorsed five years ago, but he did not think it was the case to-day. It would be difficult for the majority of consumers to-day to use more than 2,000 kWh per head per annum, but it might probably do so in the near future. Until they got rid of the method of charging solely by the kWh he did not think they would make the consumer greatly interested in his own consumption.

Mr. Howard (Taunton) asked Miss Partridge whether she recommended selling electricity at just over 0.5d. per kWh, if it was bought cheaply from the grid, in districts wherein for every 1,000 kWh supplied 500 kWh were taken up in iron losses in the transformers.

Mr. Heath (Plymouth) was of the opinion that the American block system was the best for such places as seaside resorts, where houses were not occupied all the year round.

In reply, Miss Partridge said she, too, thought the American block system was quite the fairest way of charging for electricity. She considered it unfair to apply the same tariff to people who used electricity for all purposes and to those who used it only for lighting.

War Souvenir Transformed into Electricity Kiosk.

A novel use has been found for an old war tank at Ashford, Kent, according to the *Star*, by adapting it for use as an electricity supply kiosk. The engine inside the tank was removed and the tank now contains switchgear and a transformer to meet the increasing demands of the district for electricity.

National Smoke Abatement Society.

A public conference on "By-laws under Section 5 of the Public Health (Smoke Abatement) Act, 1926," will be held by the National Smoke Abatement Society on May 2nd at 71, Eccleston Square, S.W.1, at 3.30 p.m. The discussion will be opened by a paper to be read by Mr. C. J. Allpass.

Institution of Electrical Engineers.

INFORMAL MEETING.—At the informal meeting of the Institution on March 31st, Mr. J. R. Bedford was in the chair when Capt. P. P. Eckersley opened a discussion on "Loud-speakers." Owing to the large attendance the meeting was transferred to the lecture theatre, which was nearly filled. Capt. Eckersley said that in wireless service the loud-speaker presented the greatest difficulty. It ought to be possible to assume that transmission could be effected without distortion, but there remained the difficulty of producing a sound-field round the listener equivalent to the sound-field at the microphone, and he felt that much of the trouble arose because users expected too big a compass of sound. If they could get sound up to 4,500 cycles, need they bother about the further gamut? He described the three common types of electrostatic, moving-iron and moving-coil loud-speaker, and expressed some preference for the m.i. type, though he said the m.c. did appear to have the advantage, as its resonance was so good at low frequencies; it had volume, elasticity, and damping. Close study of the speaker horn might lead to improved construction that would eliminate much of its inherent defect, and he suggested drilling a series of holes in the stem. Cones had the advantage of considerable damping, but their disability was that if one generated high frequencies only part of the cone moved correspondingly, and a "break-up" of the cone unity resulted. Where, he asked, should progress lead? The human ear was drugged by noises to which it had become trained, and was unable to make an impartial selection of sound purity. It could not be assumed, therefore, that people wanted reality. What did reproduction mean? Should they aim at the perfect gamut without transients, or adapt distortion and dignify it by the name of Art?

Mr. A. G. Warren said resonance round the commercial moving-coil loud-speaker was a matter of getting the right type of diaphragm. He wanted to know how a transient got past the detector valve.

Mr. H. J. Neill said a moving-coil loud-speaker free from resonance was in commercial use. Within reasonable ranges it gave admirable results, but on outer frequencies it was appalling. It had an enormous horn, but there was nothing else remarkable about it. Its effects were due to very careful construction along standard lines with the utmost attention to small details.

Twelve other speakers took part in the discussion.

Our Personal Column.

Electrical men are invited to enable us to keep readers of the "Electrical Review" posted concerning their movements.

Mr. F. A. ORCHARD, A.M.I.E.E., has joined the staff of Mr. D. Maxwell Buist, M.I.E.E., engineer for the Central Electricity Board in the North-East England Area. Mr. Orchard has been twelve years with Messrs. Merz and McLellan, Newcastle-on-Tyne, with whom he was engaged chiefly in the supervision of large contracts for super-power station switchgear and sub-station equipment, both at home and abroad, and latterly was responsible for the electrical inspection organisation. Prior to joining Messrs. Merz and McLellan, he had extensive design and commercial experience with the British Westinghouse Co., Dick, Kerr & Co., the British Thomson-Houston Co., Ltd., and Siemens Bros. Dynamo Works. Mr. Orchard takes up his duties on May 1st.

Elliott & Fry] [*London.*

Mr. F. A. Orchard, A.M.I.E.E.

Who is joining the Central Board's Staff.

Mr. PERCY WARDLE, of Walsall, has been appointed chief electrical engineer and general manager of the electricity undertaking of the Cannock Urban District Council, in succession to the late Mr. H. L. Thomson, at a salary of £500 per annum, rising by annual increments to £650, with the addition of a house. There were 173 applications for the post. Mr. Wardle is 41 years of age, and is an associate member of the Institution of Electrical Engineers; he has been mains engineer and chief assistant to the Walsall electricity undertaking for the past ten years, and was previously mains superintendent at Carlisle.

Mr. ROBERT AITKEN, M.I.E.E., superintending engineer for the West of Scotland district, has just retired from the Post Office Telephone Service. Mr. Aitken joined the National Telephone Co. in 1891. In 1896 he went on a tour of the country with Mr. Dane Sinclair, manager of the National Co., and Sir John Gavey, in connection with the valuation of the trunk telephone circuits previous to their transference to the State. When the Post Office took over the system, Mr. Aitken joined the Engineering Department as assistant superintending engineer, and he was promoted in 1926 to the position of superintending engineer in the West of Scotland district. At a recent gathering of the staff in Glasgow he was presented by Major John Cameron, C.B.E., assistant superintending engineer, with a radio set and loud-speaker.

The *Industrial Australian and Mining Standard* reports that Mr. P. J. PRINGLE, general manager and chief engineer of the Electric Supply Co. of Victoria, Ltd., and Mrs. Pringle, left Australia for England on February 25th. They expected to be away for seven months.

Epsom Urban Council has increased the salary of the power station superintendent, Mr. W. B. HAYDEN, and that of the mains superintendent, Mr. F. H. ROBINSON, to £350 per aanum as from April 1st, with a further advance to £400 by two annual increments of £25.

Mr. W. H. HUTCHINSON has been elected president of the Amalgamated Engineering Union in succession to Mr. J. T. Brownlie, who has retired under the age limit.

Sir GERALD E. C. CHADWYCK-HEALEY, Bt., C.B.E., chairman of Morgan Brothers Publishers, Ltd., will preside at the eighty-second Anniversary Festival of the Royal Metal Trades Pension and Benevolent Institution, the date and particulars of which will be published later.

Mr. W. B. WOODHOUSE, engineer and manager of the Yorkshire Electric Power Company, has been appointed a director of the Electrical Distribution of Yorkshire, Ltd., to fill the vacancy caused by the death of Mr. A. G. Lupton.

The Chairman of the Electricity Commissioners, with the concurrence of the Minister of Transport and the other Commissioners, has appointed SIR JOHN REEVE BROOKE, C.B., to be Vice-Chairman of the Commissioners on the retirement of Sir Harry Haward from that position on March 31st.

At a general meeting of the Royal Institution on April 7th Sir JAMES DEVONSHIRE was elected a member of the Institution.

Mr. WILLIAM MCGEOCH, of Messrs. William McGeoch and Co., Ltd., Birmingham, has been elected president of the Brassfounders' Employers' Association, Birmingham, for 1930. Mr. W. PERCY MCGEOCH, of the same firm, retires from the presidency of the Birmingham Junior Chamber of Commerce next month on completion of his term of office. He was a

member of the Fair Management Committee, British Industries Fair, 1930, Birmingham.

Mr. R. H. Wilkinson, general manager of the Bradford City tramways, is taking a holiday in Madeira. He has been in poor health lately; we trust that his vacation will set him up again.

The Electricity Commissioners have approved the granting of £1,050 as an honorarium to Mr. E. E. Hoadley, borough electrical engineer of Maidstone. When the proposal was brought forward towards the end of last year, the chairman of the Electricity Committee stated that the special services rendered by Mr. Hoadley had saved the Council £6,000 in fees for outside advice.

The Hazel Grove and Bramhall Urban Council has appointed Mr. R. Lomax to the temporary position of electrical engineer and manager. He commenced his duties on March 10th.

The Watford Town Council has fixed the maximum salary of the borough electrical engineer, Mr. A. W. Barham, at £1,250, the sum which he is at present receiving.

Mr. S. G. Davey, who has been tramway traffic superintendent to the Exeter Corporation since 1924, has been appointed to a similar position with the Derby Corporation.

Obituary.—Mr. T. von Zweigbergk.—We regret to learn of the death of Mr. Thorsten von Zweigbergk, at Stockholm on February 11th, after a long illness. Zweigbergk first made his mark in the electric traction world when with the Walker Electric Co. Under Prof. Sidney Short this company supplied traction equipment which was very successful in service and was well known in England. The Walker Electric Company was absorbed eventually by the Westinghouse Company and Professor Short brought his staff to England, where they assisted in building up the Preston works of Messrs. Dick, Kerr and Company in 1900. On Professor Short's death in 1904 Zweigbergk became responsible for all the traction work of Messrs. Dick, Kerr & Co., and later of the English Electric Co., of which that company became a part. Zweigbergk's name is associated with the invention of the metallic shield blow-out and its applications to tramway and railway controllers. Controllers on this system gave excellent results in service even for currents up to 4,000 A. Perhaps the best known of the earlier railway electrification schemes for which Zweigbergk was responsible were the Liverpool to Southport line of the Lancashire and Yorkshire Railway and the Liverpool Overhead Railway. Later he designed the first electrification of the Bury, Holcombe Brook line of the L. & Y., which was carried out at 3,000 volts d.c., the traction motors being wound for 1,500 V and connected two in series. This was one of the first 3,000-V systems put into practical operation. Zweigbergk's work was characterised by soundness of mechanical design. He was a designer by instinct as well as by training, and his work was unmistakable to anyone skilled in the art. He was widely known in the traction world, and his loss will be greatly felt.

Dr. W. S. Hedley.—We record with deep personal feelings of regret the death of Dr. William Snowdon Hedley, which occurred on Monday last, April 7th, at Shorts Lodge, Liphook, Hants. He was for many years a prominent authority on electrotherapeutics and a much esteemed contributor to the Electrical Review on this subject. For several years past Dr. Hedley has been living in retirement, but, during his earlier active life, he was at one time Physician-in-Charge of the Electro-therapeutic Department of the London Hospital, also Brig.-Surg.-Army. When the Electrical Review published a Special Issue celebrating its 25th Anniversary (November 12th, 1897) he was one of the company of distinguished authorities who wrote the history of their own department of investigation and practice for us, his title being "Twenty-five Years' Progress in Electrotherapeutics." Four years ago he emerged from his well-earned retirement writing an article on "Martyrs of Science" (Elec. Rev., January 8th, 1926). His other writings included the following:—"Therapeutic Electricity"; "Hydro-electric Methods in Medicine"; "Current from the Main"; "Scope and Value of Electricity in Medicine"; and "Electric Radiant Heat Apparatus"—a number of these being published in the *Lancet*.

Mr. A. F. Rock.—The death is announced from Rhos-on-Sea of Mr. Andrew Frederick Rock, formerly of Stoke-on-Trent. Mr. Rock, who was 70 years of age, entered the service of the North Staffordshire Railway Company in 1871 as a telegraph learner and was transferred to the technical staff in 1876. He rose through various grades to be chief electrical assistant to the late Mr. John Neale, whom he succeeded as telegraph superintendent and electrical engineer in 1902.

Mr. H. C. Watson.—The death occurred on April 5th, at Bournemouth, of Mr. Henry Carter Watson, managing director of Messrs. T. B. Watson & Son, Ltd., electrical engineers, Stockton, Middlesbrough, and other towns in the north. The funeral took place on Wednesday last, at the Oxbridge Cemetery, Stockton.

Financial Section.

New Companies, Returns of Share Capital, Debenture Charges, Reports of Electrical Companies, Dividend Changes, Transactions in Stocks and Shares.

New Companies Registered.

Strombo Electric Co., Ltd.—Private company. Registered April 4th. Capital, £500 in £1 shares. Objects: To carry on the business of manufacturers of and dealers in electric lighting apparatus of all kinds, radio and other apparatus, &c. The first directors are: C. Arrigoni, 45, Salisbury Road, Lower Edmonton, N.9, mechanical engineer; K. Godwin, "Aintree," Sefton Avenue, Mill Hill, N.W.7, mechanical engineer; A. E. Howard, 22a, Brudenell Road, Upper Tooting, S.W.17, electrical merchant; H. Jones, 25, St. Leonard's Street, Victoria, S.W.1, electrical merchant. Secretary: C. Arrigoni. Registered office: 8, Compton Passage, Clerkenwell, E.C.

Tonex, Ltd.—Private company. Registered April 2nd. Capital, £500 in £1 shares. Objects:—To carry on the business of factors, vendors, and manufacturers of, and dealers in electrical instruments, apparatus, machines, accessories, and goods, &c. The subscribers are:—Beatrice Young, 23, Batoum Gardens, Shepherd's Bush, W.6, clerk; Isobel Fyfe, 82, Corrance Road, S.W.2, shorthand-typist; Annie L. Robinson, 17, Stoke Newington Common, N.16, shorthand-typist. A. F. White signs documents as director. Registered office: Walmer House, Regent Street, W.1

Kaytonion Electrics, Ltd.—Private company. Registered April 2nd. Capital, £600 in 500 8 per cent. preference shares of £1 each and 2,000 ordinary shares of 1s. each. Objects:—To acquire the business of manufacturers of gramophones and gramophone parts and radio sets now carried on at 223, New Cross Road, S.E.14, and to carry on the business of electrical and general engineers, &c. The directors are:—F. Kay, 223, New Cross Road, S.E.14, electrical engineer; G. J. Trusty, 111, Well Hall Road, Eltham, S.E.9, patents consultant. Registered office: 12, Chichester House, Chichester Rents, Chancery Lane, W.C.2.

Thomas A. Rose & Son, Ltd.—Private company. Registered April 3rd. Capital, £3,000 in £1 shares. Objects:—To acquire the business of an electrical engineer and dealer in electrical novelties now carried on by T. A. Rose at 25, Milton Street, E.C.2, as "T. A. Rose." The permanent managing directors are T. A. Rose and N. S. Rose, 25, Milton Street, E.C.2. Registered office: 25, Milton Street, E.C.2.

Pecona, Ltd.—Private company. Registered April 2nd. Capital, £500 in 400 ordinary shares of 10s. each and 300 ordinary shares of £1 each. Objects:—To acquire the business of a manufacturer and merchant now carried on by B. Nodin, of 8, Camp Street, Manchester, as "The Decona Co.," and to carry on the business of novelty manufacturers, radio engineers, electrical suppliers, &c. The directors are:—B. Nadin, electrical engineer, and Mildred Nadin, "Woodley," Thelwall New Road, Warrington. Secretary: J. Warburton. Registered office: 8, Camp Street, Deansgate, Manchester.

Herbert Smith (Bradford), Ltd.—Private company. Registered March 31st. Capital £3,000 in £1 shares (1,000 7 per cent. cumulative preference and 2,000 ordinary). Objects: To carry on the business of electrical, motor and general engineers, founders, factors and dealers, manufacturers of and dealers in accumulator batteries, plates, motors, dynamos and electrical supplies, manufacturers of plant and accessories used in connection with electrical or wireless appliances, &c. The first directors are: Mrs. E. A. Smith, 132, Clayton Road, Lidget Green, Bradford; W. Marshall, 8, Waverley Road, Bradford, electrical engineer (both permanent). Solicitors: A. V. Hammond & Co., Bradford.

Official Returns of Electrical Companies.

Shaw, Fletcher & Co., Ltd.—Debenture dated March 1st, 1930, to secure £360, charged on the company's undertaking and property, present and future, including unpaid capital. Holder: T. R. Shaw, Moniaive, Chester Road, Wrexham.

E. A. Manufacturing Co., Ltd.—P. H. Stone, 47, Temple Row, Birmingham, ceased to act as receiver and manager on March 15th, 1930.

George Hill & Co., Ltd.—Capital £4,000 in £1 shares. Return dated November 20th, 1929. 2,150 shares taken up. £2,150 considered as paid. Mortgages and charges, nil.

Fada Radio, Ltd.—Capital £10,000 in £1 shares. Return dated January 1st, 1930. 5,000 shares taken up. £5,000 paid. Mortgages and charges, nil.

Darimont Electric Batteries, Ltd.—Capital £18,000 in 62,000 ordinary shares of 5s. each, and 50,000 deferred shares of 1s. each. Return dated January 6th, 1930. All shares taken up. £8,999 16s. paid on 34,666 ordinary and 6,666 deferred shares. £9,000 4s. considered as paid on 27,334 ordinary and 43,334 deferred shares. Mortgages and charges, nil.

Metallic Seamless Tube Co., Ltd.—Capital £65,333 6s. 8d. in 20,000 preference shares of 13s. 4d., and 260,000 ordinary shares of 4s. each. Return dated February 18th, 1930. 15,245 preference and 260,000 ordinary shares taken up. £36,163 6s. 8d. paid. £26,000 considered as paid. Mortgages and charges, nil.

New Phonopore Telephone Co., Ltd.—Capital £10,000 in 9,000 ordinary shares and 1,000 founders' shares of £1 each. Return dated January 1st, 1930. 7,141 ordinary and 1,000 founders' shares taken up. £6,741 paid on 6,741 ordinary shares. £1,400 considered as paid on 400 ordinary and 1,000 founders' shares. Mortgages and charges, £2,666 13s. 4d.

Rotax (Motor Accessories), Ltd.—Capital £506,500 in 253,250 preference and 253,250 ordinary shares of £1 each. Return dated November 6th, 1929. 253,034 preference and 253,250 ordinary shares taken up. £168,867 paid on 75,000 preference and 93,867 ordinary shares. £337,417 considered as paid on the remainder. Mortgages and charges, nil.

Bullers, Ltd.—Capital £400,000 in 20,000 preference and 20,000 ordinary shares of £10 each. Return dated January 3rd, 1930. 15,000 preference and 15,593 ordinary shares taken up. £150,070 paid on 15,000 preference and 7 ordinary shares. £155,860 considered as paid on 15,586 ordinary shares. Mortgages and charges, £196,950.

Venezuela Telephone & Electrical Appliances Co., Ltd.—Capital £600,000 in 140,000 8 per cent. cumulative preference, 140,000 ordinary and 320,000 "A" ordinary shares of £1 each. Return dated December 31st, 1929. 136,975 cumulative preference, 136,975 ordinary, and 136,975 "A" ordinary shares taken up. £354,419 paid on 136,975 preference, 80,469 ordinary, and 136,975 "A" ordinary shares. £56,506 considered as paid on 56,506 ordinary shares. Mortgages and charges, £145,300.

Thalberg Halstead, Ltd.—Capital £1,000 in £1 shares. Return dated January 4th, 1930. All shares taken up. £630 paid. £370 considered as paid. Mortgages and charges, nil.

Electric Lamp Distributors, Ltd.—Debenture charged on the company's property, present and future, including uncalled capital, dated March 19th, 1930, to secure £470 7s. 6d. Holder: A. Siderman, 51, Cleveland Street, Fitzroy Square, W.1.

John A. H. Hunt, Ltd.—Particulars filed of £5,000 debentures authorised March 18th, 1930, charged on the company's undertaking and property, including uncalled capital, the amount of the present issue being £3,500.

Invincible Electrical Engineering Co., Ltd.—Capital, £1,000 in £1 shares. Return dated January 12th, 1930. 400 shares taken up. £400 paid. Mortgages and charges, nil.

Cablon, Ltd.—Capital, £2,000 in £1 shares. Return dated December 30th, 1929. All shares taken up. £201 16s. paid (being £1 per share on 2 shares and 2s. per share on 1,998 shares). Mortgages and charges, nil.

Edward Deane & Beal, Ltd.—Capital, £60,000 in 20,000 preference and 40,000 ordinary shares of £1 each. Return dated October 14th, 1929. 20,000 preference and 20,009 ordinary shares taken up. £9 paid. £40,000 considered as paid. Mortgages and charges, £5,750.

Zenith Electric Co., Ltd.—Capital, £26,250 in 25,000 ordinary shares of £1 and 25,000 deferred shares of 1s. each. Return dated December 20th, 1929. 25,000 ordinary and 23,334 deferred shares taken up. £5,563 paid on 5,563 ordinary shares. £20,603 14s. considered as paid on 19,437 ordinary and 23,334 deferred shares. Mortgages and charges, nil.

Chili Telephone Co., Ltd.—Capital, £1,000,000 in £5 shares. Return dated January 1st, 1930. 180,000 shares taken up. £581,000 paid. £319,000 considered as paid. Mortgages and charges, nil.

C. H. Hare & Son, Ltd.—Capital, £20,000 in 11,000 preference and 9,000 ordinary shares of £1 each. Return dated December 31st, 1929. 11,000 preference and 8,700 ordinary shares taken up. £12,202 paid on 11,000 preference and 1,202 ordinary shares. £7,498 considered as paid on 7,498 ordinary shares. Mortgages and charges, nil.

Edison Swan Cables, Ltd.—Capital, £150,000 in 100,000 preference shares of £1 each and 200,000 ordinary shares of 5s. each. Return dated November 13th, 1929. 900 preference and 200,000 ordinary shares taken up. £50,900 paid. Mortgages and charges, £123,000.

Bel Canto Radio Reproducer Co., Ltd.—Capital, £1,100 in 1,000 preference and 100 ordinary shares of £1 each. Return dated January 14th, 1930. All shares taken up. £1,100 paid. Mortgages and charges, nil.

Cattley Accumulator Co., Ltd.—Capital, £5,000 in £1 shares. Return dated December 31st, 1929. 2,850 shares taken up. £1,900 paid. £950 considered as paid. Mortgages and charges, nil.

Twiss Electric Transmission, Ltd. (formerly Twiss Engineering and Electric Transmission, Ltd.).—R. H. Stevens, 37, Walbrook, E.C.4, ceased to act as receiver and or manager on March 21st, 1930.

Voltron Co., Ltd.—Second debenture dated March 26th, 1930, to secure £3,000, charged on the company's undertaking and property, present and future, including uncalled capital (subject to first charge for £2,500 created March 12th, 1929). Holder: S. B. Causer, 240, Baring Road, Lee, S.E.12.

Union Welding Co., Ltd.—Charge dated April 19th, 1923, on 2, Northdown Street, Finsbury, E.C. (property acquired November 16th, 1925) on which £485 5s. 6d. was owing on November 1st, 1929. (Now registered pursuant to Section 91, of the Companies Act, 1929). Mortgagee: N. G. Driver, 32, Alexander Court, Queen's Gate, S.W.7.

Electrical Name and Numerical Sign Co., Ltd.—E. G. F. Cartwright, 4, Heathcote Street, W.C.1, was appointed receiver and manager on March 19th, 1930, under powers contained in debenture dated January 22nd, 1913.

City Notes.

Marconi International Marine Communication Co., Ltd.

The annual meeting of this company was held on April 2nd, Mr. F. G. Kellaway (chairman and managing director) presiding. In presenting the report and accounts (*vide* ELECTRICAL REVIEW, March 14th, p. 508), the chairman said that each of their associated companies was doing increasingly remunerative business. The balance of the profit and loss account (£203,111) was the highest figure ever earned by the company. These results had been secured by the application of the essential principles of rationalisation in industry. There was a fair increase in the volume of business offering during the past year, and technically, also, the year was full of interest. As a result of regulations passed at the Washington Convention of 1927, December last saw the beginning of the end, on board ship, of spark transmitters of more than ¼-kW power. By the end of the year under review the company held maintenance and rental contracts in respect of 2,758 British ships, a large proportion of which carried direction finders and auto alarm apparatus, in addition to the main installations. An unusual volume of non-current expenditure was necessary throughout 1929 to enable the company to maintain its technical lead in marine wireless apparatus. The use of short-wave telegraph apparatus became more general and gear had to be perfected to meet this growing need. Coupled with this came the necessity for the design of a marine wireless receiver fulfilling requirements of seagoing conditions in all climates that would enable operators to receive signals on any wave-length between 15 and 20,000 metres. The company had evolved apparatus which was to be adopted by it as standard on all passenger vessels. The increase in the use of wireless on trawlers referred to at the last meeting had been well maintained. During 1929 they had created the "Marine Electrical Equipments Department" to deal with band repeaters, automatic telephones, broadcast reception on board ship, and sounding devices. The research in these devices had been successful and a number of patents had been taken out. They were pioneers in marine wireless telephony, and had already rental and sale contracts in respect of over 70 marine wireless telephone equipments. The amount of business so far secured during the current year was in advance of last year, but there was a tendency to increase the number of ships laid up. Replying to a question by a shareholder, the chairman said he was aware that the International Telephone and Telegraph Corporation of New York had recently established a subsidiary in this country called the "International Marine

Radio Co.," and he understood that representatives of that company had stated that it was their intention to enter the business of providing telephone services on British ships, but so far as the shareholders of their company were concerned he did not think there was any cause for anxiety in the talk of new American competition. With regard to American competition, he would like to refer to another branch of the activity of the I.T.T. which was causing anxiety to all who were interested in the welfare of our export trade and the problem of unemployment. He referred to the extent to which the International Telephone and Telegraph Corporation of New York was acquiring control of communication companies which had been established abroad by British enterprise and financed by British capital. The effect of the disposal of these British companies to American companies was that the orders for equipment passed from British to American hands. It was hardly necessary to stress the serious effect which this process was bound to have on our export trade and on unemployment. He would like to see a determined effort made to put a stop to this process, and he was sure that any such efforts would receive the support of the Government and the City. The report and accounts were adopted.

Clyde Valley Electrical Power Co.

The accounts of this company were abstracted in our issue of March 21st, p. 553, and the annual meeting was held on April 2nd. Mr. C. Ker (deputy-chairman), who presided in the absence of Sir F. C. Gardiner (chairman), in reading the chairman's speech said that the receipts from the sale of energy had increased during the year under review by approximately £43,000. There had been no appreciable improvement in trade generally in the company's area, but the constant expansion of the company's business, particularly in domestic supplies, had more than neutralised the effects of trade depression. The capital expenditure during the year was £149,379, the larger items of which were in respect of extended boiler house and boiler equipment at Clyde's Mill, engine room and switch-house extensions for the new 20,000-kW turbo-alternator at Yoker, and sub-station buildings, of which 18 were equipped during the year. The output for the year totalled 258,000,000 kWh, an increase of 18,000,000 kWh. New contracts were signed for 24,990 h.p., the total connections showed an increase of 25,110 h.p., and the number of consumers increased by over 8,000. The turbo-alternator referred to had delivered power to the grid of the Central (Scotland) Electricity Scheme and to consumers since September. Already consumers' plant to the extent of 20,000 kW had been changed over to the standard frequency of 50 cycles in the district from Yoker westward, including Dumbarton, Helensburgh, and the Vale of Leven, and they were about to commence standardisation in the Scotstoun district. It was hoped to complete the standardisation of frequency in the whole of the company's area by the autumn of 1932. The cost of this work to date was over £322,000, and the estimated total cost about £2,500,000. The time had now arrived when it would pay the company to close down the Motherwell station and to concentrate production at the Clydes Mill and Yoker stations. The Yoker station gave them the opportunity of bringing up to date the six boilers installed in 1920, and in the completion of the new installation and the alteration of the older boilers, there would be a marked improvement in efficiency. Another 20,000-kW turbo-alternator was due to be put into commission for the coming winter, and with those two modern machines operating, with the new boilers, they would have an extremely efficient plant at Yoker. The report and accounts were adopted.

County of London Electric Supply Co., Ltd.

The balance on net revenue account for the year ended December 31st last is £1,180,944, as compared with £1,207,130 in the preceding year. Adding £94,775 interest charged to capital (Barking supply) and £364,210 brought forward, there is an available amount of £1,639,928. After deducting debenture interest, &c., and placing £28,975 to contingency fund, £10,000 to taxation reserve, £284,953 to depreciation, and £15,000 to investment reserve, there is a balance of £1,003,058. A final ordinary dividend of 8 per cent. is recommended (making 11 per cent. for the year), leaving £445,036 to be carried forward. The capital expenditure during the year was £1,022,145, the chief items of which were £552,212 for mains and £123,245 for machinery. The number of connections increased by 46,440 kW to 333,830 kW, the electrical energy sold by 51,448,147 kWh to 374,910,784 kWh, and the number of consumers by about 40,000 to over 162,000. During the year the company made three reductions in electricity charges and in December last announced a further reduction in the flat rate for lighting purposes in respect of the areas of the company within the Administrative County of London. This reduction operates as from January last. Under the development scheme for Essex supplies have been established in six districts and further supplies are to be made available in other districts at an early date. Interests have been acquired in other electricity undertakings during the year. In one case the acquisition was effected by an exchange of ordinary shares, and the ordinary share capital of the company has been increased accordingly. Special Orders were obtained for Burnham-on-Crouch and district, an adjoining area of 55 sq. miles. In addition, a part of the Barking Urban District Council's area of supply was transferred to the company. Application was made to the Electricity Commissioners for consent to extend the Barking power station, and this application is still under consideration. In December last 1,106,795 ordinary shares of £1 each were allotted to ordinary shareholders on bonus terms. Mr. C. J. Brand has been appointed a director. Meeting: April 16th.

Llanelly & District Electric Supply Co., Ltd.

Presiding at the annual meeting on April 4th, Mr. M. A. Edwards said that as several of the large users had been working on short time the consumption of electricity for industrial purposes was affected. The reduced demand for this class of supply, however, was more than offset by an increase in the demand for domestic and small power purposes. The energy sold increased from 21,843,400 to 23,675,600 kWh, and the number of consumers by 608. The extensions to Kidwelly and Gowerton were completed during the year, and it was expected to give a supply before the end of the current year in the Llandilo Fawr rural district and Tycroes. Under the Central Electricity Board's scheme, the company's station at Llanelly would continue to operate. Negotiations of considerable importance had been conducted for several months which might result in considerably changing the scope and ramifications of the business, but any agreement arrived at would be subject to the approval of the shareholders. With regard to the traction side of the business, the Bill under which the company sought to introduce railless cars and omnibuses in the place of, and in extension of, the services of the light railways, was proceeding normally. The first two months' trading of the current year showed a satisfactory increase over the corresponding period of last year. The report and accounts were adopted.

Bath Electric Tramways, Ltd.

Presiding at the annual meeting on March 31st, Mr. E. H. R. Trenow (chairman and managing director) expressed regret at the death of Mr. A. A. Campbell Swinton who had rendered valuable service to the company as a director from its formation. Referring to the operations of the company during the past year, the chairman said the traffic decreases were due in part to the severe cold and snow in the early part of the year, and the floods in the autumn which necessitated the use of omnibuses in areas which were submerged. Other factors which influenced receipts were bad trade, unemployment, and the opening of halts on the railway, and the removal of population from the area served by the tramway. The reduction in the number of passengers carried was, however, more than offset by a reduction in the car mileage, which allowed a cutting down in the number of kWh generated, with a consequent saving in fuel cost, and further reductions in general operating costs. The report and accounts were adopted.

Chelsea Electricity Supply Co., Ltd.

The report for the year ended December 31st last records a profit of £61,594, to which is added £24,039 brought forward, and interest on investments, making £90,272. Debenture interest and sinking funds take £20,413, and it is proposed to transfer £7,947 to special reserve (ordinary shareholders' proportion of consumers' benefit), and £2,565 to co-partners, and to pay a final dividend on the ordinary shares at the rate of 11.2d. per share, completing the standard dividend for the year, leaving £21,817 to be carried forward. The total connections increased by 908 kW to 14,956 kW, and the sales of energy by 1,547,036 kWh to 11,012,976 kWh.

Companies Struck off the Register.

The names of the undermentioned companies have been struck off the register, and they are thereby dissolved:—

Chippenham Electric Supply Co., Ltd.
Eureka Electric and Wireless Maintenance Guarantee Co., Ltd.
Flactem Wireless, Ltd.
Melksham Electric Supply Co., Ltd.
Midland Electrical Tube Co., Ltd.
Trowbridge Electric Supply Co., Ltd.
Winchcomb Electric Light and Power Co., Ltd.

Notting Hill Electric Lighting Co., Ltd.

The net profit for the year ended December 31st last, including £28,978 brought forward, was £91,873, from which debenture interest, &c., is deducted, leaving £55,846 available. It is proposed to pay a final dividend of 11s. 7.817d. per share, less tax, on the deferred shares, making 16s. 7.817d. per share for the year, and to carry forward £28,229. The number of consumers increased from 10,583 to 11,297, the connections from 18,017 to 19,737 kW, and the energy sold from 7,640,091 to 9,216,206 kWh. Meeting: April 16th.

Reductions of Capital.

Aluminium Corporation, Ltd.—A petition for the confirmation of the reduction of the capital of this company from £489,750 to £83,860 has been presented to the High Court and will be heard in London on April 14th.

Premier Electric Welding Co. (Newcastle), Ltd.—A petition for the confirmation of the reduction of the capital of this company from £60,000 to £25,000, has been presented to the High Court and will be heard in London on April 14th.

Western Union Telegraph Co.

The accounts for the year ended December 31st last record gross operating revenues of $145,667,196, and after the payment of expenses and bond interest a balance of $15,474,893 was transferred to surplus, making a net total of $103,823,434. Dividends paid and declared absorbed $8,188,206, leaving a surplus at December 31st last of $95,635,228. The report says that at the close of the year the Western Union system comprised 216,956 miles of pole lines, 1,896,424 miles of wire, 3,682 miles of landline cables, 30,707 nautical miles of ocean cables, and 25,061 telegraph offices.

River Plate Electricity Co., Ltd.

The net revenue for the past year was £55,745, against £53,401 in 1928. To this is added £7,404 brought forward, making £63,149. The ordinary dividend is 10½ per cent. (against 11 per cent.), and £12,500 (against £6,795) is transferred to reserve; a balance of £5,649 is carried forward. It is proposed to capitalise £22,500 of the reserve and to distribute it to the ordinary stockholders in the ratio of one £1 share to each £20 of stock held; the new shares will rank for dividend from January 1st, 1930, and will in due course be converted into ordinary stock.

Barcelona Traction, Light & Power Co., Ltd.

The London agents of the company announce that the scheme for the reorganisation of the company's capital has been approved by the Canadian Courts and a supplemental charter has been granted to the company. As we reported in our issue of February 21st (p. 358), the scheme provides for the conversion of the 7 per cent. participating preference and ordinary shares into shares of no par value and the creation of 400,000 additional shares of no par value. The capital will then comprise 2,198,854 shares of no par value.

Windermere & District Electricity Supply Co., Ltd.

The report for 1929 shows a balance from revenue account of £8,555, and after adding £803 brought forward, loan and bank interest, &c., and providing for debenture interest, &c., £10,060 is available, of which £2,000 is transferred to depreciation reserve, £1,250 to reserve, £500 to income-tax account, £250 is written off capital account (free wiring), and £492 written off investments. A dividend of 4 per cent. per annum is proposed on the ordinary shares, leaving £1,092 to be carried forward.

Keswick Electric Light Co., Ltd.

The total revenue for the year ended December 31st last was £6,531. After meeting debenture interest, &c., there is a balance available of £6,264, from which £1,000 is placed to reserve, £150 to income-tax reserves, £750 to depreciation, and £50 is written off free wiring account. It is proposed to pay a dividend of 10 per cent. on the ordinary shares, and to carry forward £92.

Edison Swan Electric Co., Ltd.

The net profit for the year ended December 31st, 1929, was £80,965, as compared with £76,991 for the preceding eighteen months. The ordinary dividend is maintained at the rate of 10 per cent.; £30,000 (against £50,000) is transferred to reserve, making the latter £280,000; and £13,250 is carried forward. Meeting: April 16th.

Cammell, Laird & Co., Ltd.

There was a profit of £11,809 for the past year, after meeting depreciation and debenture interest; in the preceding year there was a loss of £80,694. No dividends are to be paid, however. The preference dividend is in arrear from June 30th, 1925.

German Companies.

The *German Telephone Works and Cable Industry Company*, Berlin, has carried forward the net profits of 112,000 marks (87,000 marks in 1928) earned in 1929. At the annual meeting it was stated that the turnover had recently fallen off as compared with last year, owing to the general weakening in the situation of trade.

The *Electricity Supply Company*, Berlin, in the course of its report for 1929, mentions the formation of a company for the operation of the Adana electricity works in Turkey, whose capital of £T1,000,000 has been taken over by the company and whose prospects are favourable. The net profits of the Berlin company are returned at 4,330,000 marks, as against 3,790,000 marks in 1928, and the dividend remains at 10 per cent.

Belgian Company.

The report of the *Compagnie de Constructions Electriques de Belgique* states that the orders booked in 1929 were considerably greater than those in the previous year, but the increase in the production was hampered by delay in carrying out the extensions at the Herstal works and the scarcity of skilled labour. The new installation had since been completed and the difficulties in recruiting labour had disappeared. The accounts show net profits of 3,377,000 fr. and the dividend is at the rate of 16 fr. per share. Most of the orders received last year were from Belgian customers; the export trade is said to have become difficult owing to Customs barriers and the high fiscal burdens which press on the costs of production.

Stocks and Shares.

TUESDAY EVENING.

STOCK Exchange markets have now entered upon the long account which precedes Easter, and which, this year, includes the Budget as well as the holidays. The outstanding feature is the way in which shares of the American utility companies are bounding ahead. The speculative wave in America threatens to rise as high as it did last year, although, according to accounts from the other side, efforts are being made to confine the gambling within moderate limits. The effect upon the London stock and share market is to postpone the hope of Bank Rate reduction, and this, in its turn, reacts upon prices of gilt-edged securities. The latter are not so strong as they were, and a few prices show material reaction from the recent top prices. Up to the present, the gilt-edged stocks in the various electricity sections have scarcely suffered. Central Electricity fives hold their advance at 99, though North-West Midland 5 per cent. debenture at 98½ is 10s. down. North Metropolitan Electric new 5¼ per cent. debenture dealings in which started on the basis of 2 premium, is now up to 4¼ premium. West Gloucester 5½ per cent. debenture is available at 97½ free of stamp duty.

The Central Electricity Board.

The second annual report of the Central Electricity Board will be the more generally scanned by reason of the wider circle of public attention now directed to the Board by the number of investors who hold the stock. When the last issue of stock was made, early in the new year, a fairly comprehensive picture was presented in the prospectus of the Board's activities, and to this the present report adds details that give an interesting glimpse of the amount of work being done in the carrying-out of the important programme that the Board has in hand. There is still a great deal to be done before the programme can be regarded as even approximately complete, and further issues of stock will be made, no doubt, from time to time as the money is required. Some of the critics maintain that the Board's report is disappointing, in that it shows this country to be still behind various other nations in the development of electricity. According to one calculation, industry in the United States and in Germany is electrified to the extent of over 80 per cent., whereas in this country the comparative figure is no more than 59 per cent. The provision of power at a low price is essential, according to this argument, for the process of electrification to be accelerated and completely carried out.

Home Electricity Supply.

Notwithstanding the relaxing of strength in various investment markets, the list of shares in Home electricity supply companies exhibits notable improvement. Reference to the section at the top of our table gives some idea of the way in which demand presses for shares in the sound concerns. Where dividend deductions were made from prices last Thursday, the Stock Exchange pay-day, the amounts have been recovered in various cases, while in others the prices have gone ahead under the influence of purchases which already have absorbed most of the floating supply that was available. In this advance, the provincial companies' shares have participated with those of the London undertakings, and there is vague talk of fresh issues of capital which are likely to be made after Easter, and at prices which will give to the share allottees the opportunity of selling at a profit if they wish to do so. The County of London Electric Supply Company, in its annual report, shows that the total number of units sold last year was 51½ millions higher than that touched in the previous twelve months. The company continues to make progress in the direction of acquiring interests which will give it control of business in the area in which it works, and mention is made in the report of the reductions by which consumers have benefited in the charges for current.

The Notting Hill Electric Lighting Co. publishes figures curiously similar to those of a year ago. The available profit of £91,873 is merely £149 higher than that in the previous 12 months. But customers benefited to the extent of £25,020. The dividend on the deferred shares is raised to 16s. 7d., being 2s. 7d. higher. This is in accordance with the terms of the sliding scale under which shareholders may receive distribution extra to the statutory dividend as a sequel to the reduction in the price of current to customers. Charing Cross ordinary have risen 1s. 6d. to 27s., St. James' are better at 27s. 6d., and Westminsters at 26s. 6d. Electric Supply Corporation, at 47s., have gained 1/16. Isle of Thanet ordinary are a trifle lower at 29s. 6d., British Light & Power keep steady at 13s. 6d., and Atlas shares are 29s. middle. Northamptons strengthened to 44s. 6d. A new issue of 600,000 Scottish Power ordinary is to be offered at 27s. The existing shares are a trifle lower at 29s., but the preference firmed up to 22s. 6d.

Home Railways.

Consideration of the prospects that lie ahead of the Metropolitan Railway has led to further demand for the stock, the price of which has risen to 65, while Districts are also ¼ better at 77½. The Underground Electric Railway issues show no particular change. The Southern Railway has made an issue of £3,000,000 5 per cent. redeemable guaranteed preference stock at 98½, due for repayment at 100 on June 30th, 1957. The stock was very promptly subscribed. There is already a similar stock in issue, the price of which is a little higher than that of the newcomer. The money is required for extension of and addition to the facilities available to the public through the electrification of the line. The stock is a first-rate security, deserving the favourable attention of investors content with about 5 per cent. on the money, and it carries the prospect of appreciation in price if money should become cheap.

Cables and Wireless.

The sharp reaction which occurred last week in the stocks of the Cables and Wireless group has been checked, and, on a little speculative buying, a firmer tendency was communicated to the stocks as a whole. The "A" stock is, however, 1 lower at 60½. Speculation in this stock is dependent mainly upon the view which is taken in regard to the dividend likely to be declared in the course of the next two or three months, and it may be of use to mention that present anticipation looks for 3 per cent. as a cautious estimate, against, it may be observed, the hope this time last year of the stock receiving at least 6 per cent. in respect of the first year's working of the merger. Had the Post Office proved more amenable to what are regarded as the claims of an Imperial service, it is pretty safe to say that the stocks of the group would be standing materially higher than they do to-day.

Great Northern Telegraphs retain their rise at 32. Marconi Marines, quoted ex dividend at 2 3/16, show no real change. Oriental Telephones are a little lower. Automatic Telephones at 37s. 6d. are ex dividend. American Telephone and Telegraphs hold their substantial rise at 270, and International Telephone and Telegraphs at 70 are 3½ points higher on the week. Postal Telegraph and Cable 5 per cent. debenture stock remains at 90, and the 5 per cent. collateral trust gold bonds are 96. Anglo-Portuguese Telephones, which went ex 1s. dividend last week, are attracting a little attention round about 22s. Something of a feature was provided by a jump in Canadian Marconis to 28s. 6d., which makes a rise of 4s. 9d. on the week. The demand came mostly from New York and Montreal.

Dollar Stocks.

Very considerable rises have taken place in the stocks and shares of companies connected with utility undertakings in the Americas. Brazilian Tractions continue to be the centre of activity, and the common shares at 52 are 3½ points up, while the preference at 170 show a gain of 20. Mexican Light and Power have risen 17 to 94½, on Brussels buying. Barcelona Traction shares, which come into this group, have risen 5 to 37½. Hydro-Electrics at 57 are 5½ better. Mexico Trams at 30½ are 6 points up. Montreal Light, Heat and Power, now quoted ex dividend at 156½, are 10 points to the good, without allowing for the dividend deduction of 60 cents. Shawinigan shares at 82 have risen 4, and Canadian General Electrics at 400 have put on 55 points during the week. Calgary Power rose 20 to 180. International Holdings, which have followed the course of Hydro-Electrics, are 1½ up at 7½. Radio Corporations at 60½ show a gain of 4½, the price having been several points higher before reaction occurred. Rises such as these serve to emphasise the demand for money in America, and to explain why speculation on the other side of the Atlantic requires financial accommodation to an extent which has a direct effect upon the conditions of the money market in London. The people in this country are taking but a mild interest in these American speciality shares, but in the New York Stock Exchange the improvements are accompanied by a substantial increase in the turnover, and by constantly increasing demands for fresh money to finance the purchases.

The Manufacturing Group.

One of the features here is a rise of 3s. 6d. in Associated Electrical Industries, raising the price to 31s. 6d., the stimulus coming from American purchases of the shares. A still more considerable increase has been secured by General Electric ordinary, which have risen 8s. 9d. to 55s. under the pressure of American buying. General Electric preference at 24s. recovered the shilling which they shed last month. Henleys have strengthened to 6 9/16. British Insulated, quoted ex the dividend, are unchanged at 3½, and Telegraph Constructions also recovered the amount deducted, 18s., the price continuing at 22½ xd. India-Rubber shares declined to 10s. In the iron and steel group, there is no outstanding feature of interest. Babcock & Wilcox hold their price at 3½ xd., which shows the addition of the dividend to the price. Ever-Ready shares continue to advance, the ordinary being a florin up at 21s. 6d.; the 7 per cent. participating preference stand at 29s. 6d. The rubber share market is inanimate.

Share List of Electrical Companies.

	Nom.	Approx. Dividend. 1927.	1928.	Price April 8 1929.	Rise or fall	Yield p.c.
Home Electricity Companies.						
Bournemouth and Poole	£ 1	15	15	8½	—	4 16 0
Brompton Ordinary	1	8½	8½	26/-	+6d.	5 7 8
Charing Cross Ordinary	1	8½	8½	27/-	+1/6	5 3 8
do. do. 4½% Pref. ...	1	4½	4½	17/-	—	5 6 0
Chelsea	1	8¾	8¾	26/-	+6d.	5 7 8
City of London	1	10	10	33/3xd	+½	4 4 6
do. do. 6% Pref.... ...	1	6	6	22/6xd	+6d.	5 6 8
Clyde Valley	1	8	8	37/-xd	—	4 6 6
County of London	1	7	10	47/6	+6d.	4 4 1
do. do. 6% Pref.... ...	1	6	6	22/6	—	5 6 8
Edmundson's 7% Pref.	1	7	7	24/-	—	5 16 9
Elec. Supply Corporation	1	11	11	47/-	+⅛	4 13 7
Kensington Ordinary	1	8	8	26/-	..	5 7 8
Lancs. Light and Power	1	7½	7½	27/	—	5 11 1
London Electric	1	8½	9	28'6	—	4 18 0
Metropolitan	1	9	10	41/3	—	4 17 0
do. 4½% Pref.	1	4½	4½	17/6	—	2 10 0
Midland Counties	1	6½	7	29/-	—	4 6 7
Mid. Elec. Power	1	15	8	32/6	—	4 18 6
Newcastle-on-Tyne Ordinary ...	1	6	6	25/-xd	+6d.	4 16 0
do. 7% Pref.	1	7	7	25/6xd	+6d.	5 9 10
Notting Hill 6% Pref.	10	6	6	10¾	—	5 11 6
North Met. Elec. 6% Pref. ...	1	6	6	22/6	+6d.	5 5 9
St. James' and Pall Mall	1	6	8	27/6	+6d.	5 1 10
Scottish Power	1	8	8	29/-	- 2	5 3 8
South London	1	6½	8½	27/6xd	+6d.	5 1 10
Urban Ordinary	1	7	7	33/9	—	4 2 10
Westminster Ordinary	1	8½	8½	26/6	+6d.	5 5 8
Whitehall Elec. Invst. 7½% Pref. ...	1	7½	7½	24/6	—	6 2 5
Yorkshire Elec.	1	8	8	33/9	—	4 14 8
Home Rails.						
Central London Ord. Assented ...	Stock	4	4	76	—	5 5 8
Metropolitan	"	3½	4	65	+½	6 3 1
do. District	"	4	5	77½	+½	6 9 0
Underground Electric	£1	7	8	23/-	- 6d.	£ 19 2
do. do. Income ...	Bonds	6	6	110	—	5 9 2
Telegraphs and Telephones.						
Anglo-Am. Tel. Pref.	Stock	6	6	102½	—	5 17 1
do. Def.	"	1½	1½	24½	—	6 2 5
Automatic Telephone	1	10	12½	37/6xd	—	6 13 4
Cables & Wireless 5½ Pref.	Stock	—	5½	98	—	5 12 3
do. A 7½ Ord.	"	—	—	60½	—1	... ..
do. B Ord.	"	—	—	31½	—	... ..
Globe Tel. and T. Ord.	10	10	10	22	—	*4 11 0
do. do. Pref.	10	6	6	11½	—	5 9 1
Great Northern Tel.	10	20	20	32	—	6 5 0
Marconi-Marine	1	12½	15	3 2/16xd	—	6 17 0
Oriental Telephone Ord	1	12	12	54/6	—2d.	*4 8 0
Home and Foreign Trams, &c.						
Anglo-Arg. Trams First Pref. ...	5	5½	5½	8	—	3 4
do. do. 2nd Pref. ...	5	6	6	8 1/16	—	9 16 0
do. do. 5% Deb. ...	Stock	5	5	70½	—	7 1 10
British Electric Traction Def. Ord.	"	5	5	1625	—	... ..
do. do. Pref. Ord.	"	8	8	125½	—	6 7 6
Brazil Traction	100	7	8	52	+3½	3 17 0
Brit. Columbia Elec. Rly. Pcc. ...	Stock	5	5	92½	—	5 8 1
London & Sub. Trac. 5% Pref. ...	1	Nil	Nil	10/-	—	... ..
London United Tram Deb. ...	Stock	4	4	52½	—	7 13 4
Mexico Trams, 5% Bonds	—	5	5	64½	—	7 15 0
Mexican Light Common	100	Nil	Nil	94½	+17	... ..
do. 7% Pref.	100	7	7	78½	—	9 5 4
do. 1st Bonds	—	5	5	76	—	6 11 7
Victoria Falls Ord.	1	15	15	3 7/8	+⅛	4 17 10
Yorkshire (West Riding)		Nil	Nil	4/3	—	... ..
Manufacturing Companies.						
Assoc. Elec. Ord.	1	8	—	31/6	+3/6	5 16 2
Babcock & Wilcox	1	18	15	3½	—	*4 16 0
British Aluminium Ord.	1	10	10	45/6xd	- 1/-	4 7 9
British Elec. Transformer Pref. ...	1	7	7	10/-	..	... ..
British Insulated Ord.	1	15	15	3¾xd	+1/6	5 17 6
Brush Ord.	Stock	10	10	12¾	—	7 16 1
Callenders	1	18	18	32	—	4 0 0
do. 6½% Pref.	1	6½	6½	23/9	—	5 9 5
Crompton Parkinson Ord.	£/-	—	30	22/6	—	5 13 4
do. 5% Pref.	1	5	5	24/6	—	5 10 8
Edison-Swan 1st Pref.	1	7½	7½	34/6	—	7 1 1
do. 5% Deb.	Stock	5	5	84½	—	5 12 4
Electric Construction	1	7½	8½	11/3	—	9 16 6
Enfield Cable Ord.	1	20	20	4½xd	—	4 9 0
English Electric	1	Nil	Nil	3/9	—	... ..
do. do. Pref.	1	8	Nil	7/6	—	... ..
Gen. Elec. Pref.	1	6½	6½	24/-	+1/-	5 8 4
do. Ord.	1	10	10	2⅝	+8/9	3 12 9
Henley...	1	25	30	6 9/16	+⅛	4 11 6
do. 4½% Pref.	5	4½	4½	4½	—	5 0 0
India-Rubber	1	Nil	Nil	10/-	- 9d.	... ..
Johnson & Phillips	1	10	—	37/6	—	5 6 8
Siemens Ord.	£	7½	7½	25/-		6 0 0
Telegraph Construction	10	10	10	22½xd	+18/-	*5 6 8

* Dividends paid free of Income Tax.

Electrical Exports of Germany.

A Comparison of the 1928 and 1929 Figures.

THE following statistics showing the value (in thousands of Reichsmarks), weight in double centner (equals 220 lb.), and in some instances the number of pieces, of electrical apparatus exported from Germany in 1929 are based on the official foreign trade returns of that country. The figures for 1928 are added for purposes of comparison, and notes of increases and decreases are made. For both years the totals include exports on reparation account.

The returns subdivide the group covering dynamos, motors, convertors, and transformers into six classes according to weight, and give the principal destinations of each class. In 1929 Great Britain, Holland, Sweden, and Argentina figured prominently among those up to 150 kg. in weight; Russia, Holland, Argentina, and Brazil were good customers for those from 150 kg. to 3,000 kg., whilst of those over 3,000 kg., 106 went to Russia, 135 to France, 79 to Spain, 60 to the Dutch East Indies, and 71 to Argentina.

	1928.	1929.	Inc. or dec.
Electric lighting and starting apparatus for motor vehicles—			
Value	6,942	6,970	+ 28
(Double centner)	6,904	7,980	+ 1,076
Number	80,307	87,000	+ 6,693
To Czecho-Slovakia ,,	18,952	18,550	− 402
,, Austria ,,	16,741	13,240	− 3,501
,, Italy ,,	12,797	16,970	+ 4,173
Dynamos, motors, convertors, and transformers up to 5 d.-centner—			
Value	35,624	41,480	+ 5,856
Number	610,719	739,920	+129,201
(Double centner)	103,017	118,930	+ 15,913
Ditto, from 5 to 30 d.-centner—			
Value	17,698	17,410	− 288
Number	7,289	7,510	+ 221
(Double centner)	78,653	76,150	− 2,503
Ditto, over 30 d.-centner—			
Value	21,249	22,980	+ 1,731
Number	1,274	1,160	− 114
(Double centner)	119,010	132,860	+ 13,850
Armatures and commutators—			
Value	9,338	8,900	− 438
(Double centner)	26,182	20,700	− 5,482
Accumulators, plates, &c—			
Value	7,841	6,490	− 1,351
(Double centner)	44,209	41,740	− 2,469
To Denmark ,,	5,174	5,660	+ 486
,, Finland ,,	5,332	1,800	− 3,532
,, Holland ,,	10,080	9,620	− 460
,, Sweden ,,	7,235	4,230	− 3,005
,, Argentina ,,	2,723	2,170	− 553
Electric cable—			
Value	47,127	59,250	+ 12,123
(Double centner)	490,395	555,960	+ 65,565
To Denmark ,,	2,796	10,230	+ 7,434
,, Holland ,,	93,282	143,170	+ 49,888
,, Gt. Britain ,,	*	19,860	—
,, Netherlands Indies ,,	*	25,680	—
,, Norway ,,	16,469	9,300	− 7,169
,, Sweden ,,	29,150	21,740	− 7,410
,, Poland ,,	10,120	4,960	− 5,160
,, Argentina ,,	88,300	66,450	− 21,850
,, Japan ,,	21,900	19,030	− 1,870
,, Finland ,,	27,500	16,960	− 10,540
,, France ,,	44,000	60,530	+ 16,530
,, Irish Free State ,,	*	12,490	—
Insulating material of asbestos, mica, and micanite—			
Value	601	840	+ 239
(Double centner)	552	650	+ 98
Measuring and recording instruments—			
Value	37,597	43,900	+ 6,303
(Double centner)	29,235	33,700	+ 4,465
To Gt. Britain ,,	1,770	2,290	+ 520
,, Italy ,,	3,290	3,040	− 250
,, Holland ,,	2,640	3,490	+ 850
,, Russia ,,	3,050	2,510	− 540
,, Sweden ,,	1,600	1,950	+ 350
,, Spain ,,	1,270	1,790	+ 520
,, Czecho-Slovakia ,,	1,160	1,250	+ 90
,, Japan ,,	1,080	1,700	+ 620
,, Argentina ,,	1,700	1,940	+ 240
Arc lamp carbons—			
Value	1,920	2,820	+ 900
(Double centner)	6,844	7,880	+ 1,036
Metal-filament lamps—			
Value	33,861	37,490	+ 3,629
(Double centner)	12,964	13,600	+ 636
(Hundreds)	689,856	808,100	+118,244
To Denmark ,,	36,250	40,190	+ 3,940
,, Finland ,,	16,950	15,690	− 1,260
,, France ,,	22,070	41,940	+ 19,870
,, Gt. Britain ,,	84,300	74,540	− 9,760
,, Italy ,,	64,950	69,170	+ 4,220
,, Norway ,,	15,360	18,310	− 2,950
,, Mexico ,,	21,400	1,080	− 20,320
,, Sweden ,,	38,100	49,490	+ 11,390
,, Switzerland ,,	20,500	20,730	+ 230
,, Czecho-Slovakia ,,	42,400	48,590	+ 6,190
,, China ,,	23,000	27,410	+ 4,410
,, Argentina ,,	32,050	44,020	+ 11,970
,, Brazil ,,	18,400	25,760	+ 7,360
Telephone material—			
Value	27,493	38,150	+ 10,657
(Double centner)	15,615	20,090	+ 4,475
To Holland ,,	2,640	2,290	− 350
,, Switzerland ,,	780	730	− 50
,, Japan ,,	960	610	− 350
,, Italy ,,	2,200	3,790	+ 1,590
Wireless material—			
Value	49,348	68,890	+ 19,542
(Double centner)	42,796	60,660	+ 17,864
To Denmark ,,	4,050	3,820	− 230
,, Gt. Britain ,,	10,700	13,490	+ 2,790
,, Holland ,,	4,500	11,120	+ 6,620
,, Sweden ,,	2,500	2,820	+ 320
,, Japan ,,	700	270	− 430
,, Argentina ,,	2,200	2,070	− 130
Electric irons—			
Value	1,471	1,840	+ 369
Electric heating and cooking apparatus—			
Value	8,346	10,510	+ 2,164
Ignition apparatus, other than magnetos, and accessories for motor vehicles—			
Value	20,101	26,550	+ 6,449
(Double centner)	18,746	26,410	+ 7,664
To Great Britain ,,	1,270	1,370	+ 100
,, Italy ,,	1,400	1,900	+ 500
,, Holland ,,	770	920	+ 150
,, Czecho-Slovakia ,,	1,500	1,740	+ 240
,, United States ,,	4,800	9,040	+ 4,240
Electric safety and signalling apparatus—			
Value	7,594	10,240	+ 2,646
(Double centner)	11,535	14,260	+ 2,725
To Denmark ,,	750	740	− 10
,, Great Britain ,,	3,860	3,430	− 430
,, Italy ,,	450	525	+ 75
,, Holland ,,	960	1,560	+ 600
Electrical apparatus for lighting, power transmission, electrolysis, resistances, &c.—			
Value	111,877	124,990	+ 13,113
(Double centner)	312,089	330,210	+ 18,121
To Finland ,,	8,500	7,910	− 590
,, Great Britain ,,	21,300	19,040	− 2,260
,, Holland ,,	33,900	40,440	+ 6,540
,, Austria ,,	11,700	17,230	+ 5,530
,, Russia ,,	42,400	15,130	− 27,270
,, Sweden ,,	17,800	16,770	− 1,030
,, Dutch East Indies ,,	9,700	14,300	+ 4,600
,, Argentina ,,	16,800	15,690	− 1,110
Electro-medical and dental apparatus—			
Value	19,500	21,690	+ 2,190
Galvanic batteries and parts and heating elements—			
Value	12,340	14,800	+ 2,460
(Double centner)	60,841	80,640	+ 19,799
To Great Britain ,,	30,500	45,160	+ 14,660
,, Holland ,,	4,400	2,960	− 1,440
,, Sweden ,,	6,200	7,100	+ 900
Telegraph or telephone insulators—			
Value	6,270	8,420	+ 2,150
(Double centner)	61,349	85,240	+ 24,891
To Russia ,,	4,800	1,280	− 3,520
,, Switzerland ,,	6,500	5,950	− 550
,, India ,,	2,500	2,820	+ 320
,, Dutch East Indies ,,	3,800	5,130	+ 1,330
,, Irish Free State ,,	4,850	3,370	− 1,480

* Figures not available.

	1928.	1929.	Inc. or dec.
Arc, mercury, quartz, &c., lamps—			
Value	3,375	3,380	+ 5
(Double centner)	2,807	3,040	+ 133
Number	32,037	42,000	+ 9,963
To Gt. Britain ,,	3,700	1,360	− 2,340
,, Russia ,,	2,500	1,500	− 1,000
,, Sweden ,,	5,100	4,270	− 830
Carbon brushes, microphone carbons, &c.—			
Value	1,920	1,860	− 60
(Double centner)	791	880	+ 89
Electrodes—			
Value	9,819	10,180	+ 361
(Double centner)	275,753	270,390	− 5,363

The total exports of electrotechnical products last year amounted to 1,633,530 d.-centner, value 578,890,000 marks, as compared with 1,451,366 d.-centner, value 488,689,000 marks, in 1928. Imports in 1929 were 94,957 d.-centner, value 50,832,000 marks, as against 105,810 d.-centner, value 45,607,000 marks, in the preceding year. The favourable balance in this branch of foreign trade was thus substantially increased.

The Situation in China.

Foreign Trade Maintained. Advice to British Importers.

In spite of civil war and unrest in China the country's trade with the outside world is maintained at a high level. This curious fact is one of the outstanding features of a report upon economic conditions in China furnished to the Department of Overseas Trade by Sir H. H. Fox, C.M.G., Commercial Counsellor at the Peking Legation, assisted by Mr. H. J. Brett, C.M.G., Commercial Secretary at Shanghai* (Stationery Office, 2s. 6d. net).

In a general survey of the economic and financial situation in August last year, the report says that the Customs revenue for 1928 surpassed all previous records, mainly on account of the heavy trade during the last quarter in anticipation of the new tariff which came into force on February 1st, 1929. This new tariff is expected to produce an additional $80,000,000 or $90,000,000 a year, part of which is to be taken for the purpose of consolidating internal and external loans and to establish a commission for the purpose. Domestic loans have become the chief factor in raising money for the National Government, but whereas the service of these loans is generally maintained, most of the foreign obligations are in default. The Government is making an effort to place the railways on a profit-earning basis and in the reconditioning of the systems British manufacturers should receive a fair share of orders.

Electrical Production and Trade.

Progress was made by a number of Chinese industries during 1928, among them being the production of electrical materials. Not only is there a large and growing home market, but the industry has an export trade. In 1928 the value of electric lamps, fittings and material exported was 262,201 Haikwan taels (one tael=3s. approx.) as compared with 224,025 taels in 1927.

The value of electrical materials and fittings (excluding telegraph and telephone materials) imported into China during 1928 was 11,307,014 taels (against 9,867,796 taels), while the imports of electrical machinery for power stations rose in value from 1,291,351 taels to 1,315,912 taels. In connection with the latter class, the report says that most of the turbo-electric plants ordered recently have been of Swiss make, their prices as a rule being far below those quoted by British, American, and German manufacturers, although a few satisfactory orders have recently been placed with British firms. With regard to Government contracts, it is said that as the technical staffs of the Nanking Ministries have in most cases received their education in the United States they naturally have a bias in favour of American standards which are apt to colour the specifications issued, thereby placing the British manufacturers at a serious disadvantage.

Handicaps to British Manufacturers.

The report goes on to say that in reviewing the engineering trade in general during the past few years it must be admitted that the dominant position once held by Great Britain has for the time been lost, and that an ever-increasing share is being secured by Germany and America. There are probably economic and other reasons to account for this unfortunate state of affairs, but the chief one undoubtedly is that both the countries mentioned are able to produce the bulk of their engineering goods more cheaply than Great Britain, and as China is probably of all the world's markets the one in which this factor carries the greatest weight the result is only what was to be expected. Germany, it is well known, has always recognised the value of the Chinese market, and with her improved economic position as a result of the war settlement is now working hard to regain lost ground and to capture as much more as she can. As for America her interest in the market is of comparatively recent date, but aided by her great wealth and her geographical position she is obviously destined to secure a very considerable share in this important branch of China's trade. When one observes that a country of over four hundred million inhabitants imported in the year 1928 only some £4,000,000 worth of machinery and industrial plant, one is struck with the vast possibilities that lie before the engineering trade in China. That country may within the next decade go far towards making herself independent of foreign supplies in the matter of clothing and foodstuffs, but it will be many years before she can attempt to make herself the various forms of delicate and complicated machinery which her industries will require. There is no reason why Great Britain, if she can quote competitive prices and reasonably prompt deliveries, should not hold her own in the Chinese machinery market.

Recent Contracts.

Some particulars are given of orders placed abroad within recent months by Chinese undertakings, among which the following appear: At Harbin (Manchuria) a British firm recently sold two 125-kVA high-speed engines and a.c. generators of British manufacture, after keen competition with Continental firms. A British firm has secured the contract for a 5,000-kW turbo-alternator and accessories for an electric power station at Tsingtau; the original plant was German followed by Japanese and Swedish. Another British concern has received an order for a 600-kW geared turbo-generator set, with surface condensing plant and switchgear, and four other steam sets with a total capacity of 660 kW. The Ministry of Communications has signed contracts with an American concern for the installation of "Strowger" automatic telephones in Greater Shanghai and Hankow, similar to the installation recently ordered for Nanking and Hongkong. This contract (including the Nanking plant) involves a total expenditure of $3,500,000 (gold) and will be divided between the companies' factories in Chicago, Liverpool, Woolwich, and Berlin. The bulk of orders for cables will probably go to Great Britain. It is stated that further large orders for additional plant for the Shanghai electricity undertaking (now in the hands of an American syndicate) will shortly be placed in the United States and Great Britain.

It is reported that a British firm has secured the contract for a long-distance telephone service between Hongkong and Canton, estimated to cost $1,000,000. The British Consul-General draws attention to the growing importance of Canton as a market for machinery and engineering plant, and regrets that British firms are not better represented in that port, where, he states, the Germans are making marked progress. Three orders for turbo-generators of over 1,000 kW for concerns in North China have gone to Switzerland. It is understood that a fair proportion of the materials required for the railways of North China have gone to the United Kingdom. A Hunan cotton-spinning mill recently placed an order valued at £20,000 for British looms, electric motors, &c., and tenders have been invited for the extension of the mill and for electric power plant. An automatic telephone plant of American manufacture is being installed in Foochow.

The Chinese Government is showing keen interest in the development of radio-telegraphy, and contracts for two stations at Shanghai to work with San Francisco and Berlin, respectively, were placed, in 1928, with the Radio Corporation of America; an agreement has been made with a French company for a third station at that port.

Hints to British Traders.

It is recommended that the first step towards trade with China should be made through the Department of Overseas Trade which can be of great assistance, especially when the questions of agencies or local branches are under consideration. Reference is made to the growing tendency of Chinese firms to deal directly with the manufacturer or his representatives. Careful inquiries should be made before relations with Chinese firms are entered upon, for the growth of Chinese trade has led to the springing up of concerns which disappear with equal facility. The existing conditions in this respect are not satisfactory, but it is hoped that a more stable situa-

* Sir H. H. Fox has now retired; Mr. Brett is Commercial Secretary (First Grade) at Shanghai; and Mr. A. H. George has been appointed Commercial Secretary (Second Grade) at Peking.

tion will be brought about by the efforts which are being made in the direction of more settled political conditions and the gradual emergence of independent courts of law in China. Advertising is making rapid headway in China and in this direction we lag behind the Americans.

In the authors' opinion the good relations between the British and Chinese which were interrupted for a time, are being re-established, and British merchants are actively endeavouring to cultivate the goodwill of the Chinese. It is still the fact, however, that the British manufacturer does not exert himself enough to find out what the Chinese really want; he does not advertise his goods sufficiently or present them in a sufficiently attractive manner in this keenly competitive market; and he does not give the financial assistance to his agents which they can fairly claim, especially when introducing new goods to the market. The report concludes on an optimistic note by saying that British trade is still low but is rising.

Railway Electrification in Costa Rica.

A Central American State Undertaking to be Operated with Hydro-electric Power.

In November, 1927, the Government of Costa Rica commisioned the A.E.G. Co., of Berlin, to electrify the State railway network, the Ferrocarril Pacifico, for a total distance of some 80 miles on the single-phase system with an overhead trolley-wire voltage of 15,000 volts, 20 cycles. Such favourable progress has been made since the scheme was begun that the initial tests are expected to take place this month (April).

The railway connects the capital, San Josè, which has a population of 60,000, with the seaport of Puntarenas, on the Pacific Coast; the greatest altitude which the railway attains is 3,850 feet above sea level; the maximum gradient is 2.5 per cent., and the rail gauge 3 ft. 6 in. The constructional and erection work was divided into four sections, *viz.*, power station plant; overhead trolley wire and railway feeder lines; telephone and telegraph cable installations; and locomotives.

The hydro-electric power station is situated on the lower reaches of the River Poas in a district that is covered intermittently with unexplored jungles. The constructional work included the building of an overflow weir 10 ft. high and 82.5 ft. wide, with a bottom outlet sluice 10 ft. by 13 ft.; a gallery 280 yards long, a sluice gate at the gallery outlet for equalising the water level, as well as a sand trap with overflow; connected to the latter there is a channel 4,350 yards long for passing 214 cu. ft. of water per second to a water chamber. A short distance from the latter is an overflow 50 ft. long, which conducts the excess water to the river over cascades. A pipe line, 154 yards long, is laid on a mountain slope at an angle of 45 degrees and connects the water chamber with the power station, in which four turbo-generator sets have been installed. Each of the three large sets incorporates a horizontal Francis spiral turbine capable of developing 2,700 h.p. at 600 r.p.m. and 283 ft. total head, coupled to a single-phase alternator generating 2,300 kVA at 6,600 volts, 20 cycles. The fourth set comprises a small turbine developing 180 h.p. at 1,200 r.p.m. and directly coupled to a three-phase alternator of 160 kVA, 220/127 volts, 60 cycles. This set obviates the need for a house-service transformer and simultaneously supplies the light and power requirements in the immediate vicinity of the central station. The three large sets are provided with different protection gear.

As the power station is located in a very narrow valley, it is difficult of access, so that a special sub-station was erected on the top of the penstock near the water chamber for housing the transformers, the major part of the switchgear, and also the feeder-line gear. The sub-station houses two single-phase oil-immersed self-cooled 6,600/16,500-V transformers, each designed for 2,300 kVA and equipped for Buchholz protection; one three-phase transformer of 190 kVA, 220/6,600 volts; four lead-through bushings for three railway feeders and one common return line; equipment for testing the feeders; a Bendman lightning arrestor, and a small workshop, as well as testing and recording instruments, &c. The sub-station does not require any special attention, as all the oil breakers can be remotely controlled from the alternator switchboard in the main power station, where also corresponding indicating instruments are installed. All connections from the power station to the 143 yards distant sub-station are composed of steel-tape armoured cables.

The trolley wire network was divided into three independent sections of 24, 26¼, and 32 miles length. Three feeders, each having a cross-section of 0.108 sq. in., and one return line of 0.186 sq. in. cross-section, strung on common lattice girder poles, run from the sub-station to the main feeding point at Turrucares; the length of this overhead line is some 3½ miles. In Turrucares, the three sections are so fed that two sections are directly supplied, whereas to feed the third section the feeeder line is carried on the poles of the trolley-wire line to the feeding point at Coyolar. The trolley line is constructed on the catenary suspension system, and special regard was paid to simple erection and attendance as well as to bird guards. Double-T broad-flange beams of normal profile 5.5 in. by 5.5 in., 5.9 in. by 5.9 in., and 6.3 in. by 6.3 in. in lengths of from 22 to 27 ft. were used for the first time as trolley-wire poles for a fairly long section. All the poles have screwed-on feet of the simplest design and are mounted on anchorings grouped into the pole foundations. The trolley wire has a cross-section of 0.124 sq. in., the cross-sections of the catenary wire rope and the droppers being 0.0543 sq. in. and 0.0155 sq. in., respectively. Having regard to the bird guards provided to prevent short circuits being formed by large birds settling on the brackets of the poles, it was decided to depart from the rod-insulator-bracket design and employ pin-type insulators made of "Steatite," mounted on supports fixed to the side, and also on the crown of the poles; rod insulators are retained at the straining points. To improve the conductivity of the rails, rail connectors of 0.0543 sq. in. cross-section have been welded on over the entire length of the track. Four sets of Bendmann apparatus are provided for protecting the trolley wire system against lightning discharges; one of them is located in the sub-station, the other three being mounted on poles in the open at the terminal points of the three feeder sections.

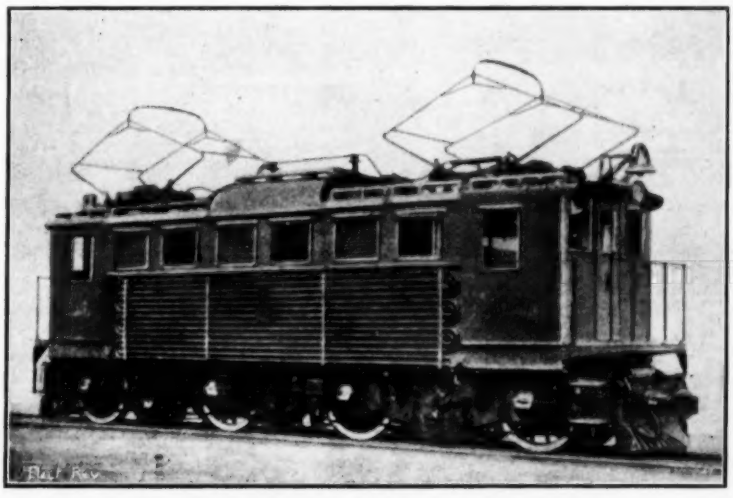


Fig. 1.—Electric Locomotive for Costa Rica.

Eight electric locomotives are being supplied for the system, the total weight of each being about 56.8 tons. The engines are equipped with four axle-slung motors with lateral drives, each rated for 115 kW continuously at 675 r.p.m., corresponding to a speed of 15½ m.p.h.; or 145 kW for one hour at 1,350 r.p.m., corresponding to a maximum speed of 30 m.p.h. per hour. Further, each locomotive carries a power auto-transformer of 15,000 volts, 460 kVA continuous rating, or 760 kVA on hourly duty. The locomotives are furnished with pneumatic brakes based on the Westinghouse system. Power is obtained from the overhead trolley wire by two pantograph collectors. The oil-immersed transformers are cooled by natural draught through cooling tubes located on the outer sides of the locomotive (fig. 1). Two small battery-operated locomotives, with the necessary charging plant, have also been supplied for shunting operations at the terminal stations. The stations at San Josè and Puntarenas are also each provided with a convertor set of about 100 kVA (three-phase, 60 cycles) for local lighting and power purposes. It is anticipated that the average daily load will be from 1,000 to 1,200 kW with peak of between 2,500 and 3,000 kW.

The Barton Power Station.

Summary of the main differences in design, performance, and operating results between the initial and the subsequently added sections of the municipal electricity generating station at Manchester.

By H. L. GUY, M.I.Mech.E., A.M.I.E.E., and H. C. LAMB, M.I.E.E., M.I.Mech.E

(*Extracts from a paper read before the* North-Western Branch *of the* Institution of Mechanical Engineers, Manchester.)

(*Concluded from page* 662.)

Condenser Cleaning.—The vacuum maintained is subject to constant vigilance. The permissible fall in vacuum resulting from the fouling of the tubes has been determined by balancing the cost of cleaning against the cost of increased fuel and the inconvenience of keeping plant out of commission for condenser cleaning.

Brushing was the method of cleaning originally adopted, but it was later abandoned in favour of shooting leather bullets through the tubes by compressed air. Table III shows that the latter method effects great economy in cost and time the set is kept out of commission. A considerable saving of time is made if sufficient bullets are available to load every tube before firing is commenced. At the far tube plates the bullets are collected in a tray and a spray of town's water cleans them and also helps to keep the atmosphere in the water heads fresh. Bullets very rarely jamb in the tubes, and no condenser leakage has been caused by shifting the tubes in their gland packings by the air pressure. As a general rule condensers are cleaned at Barton when the vacuum has fallen by 0.2 in. H.g. below datum.

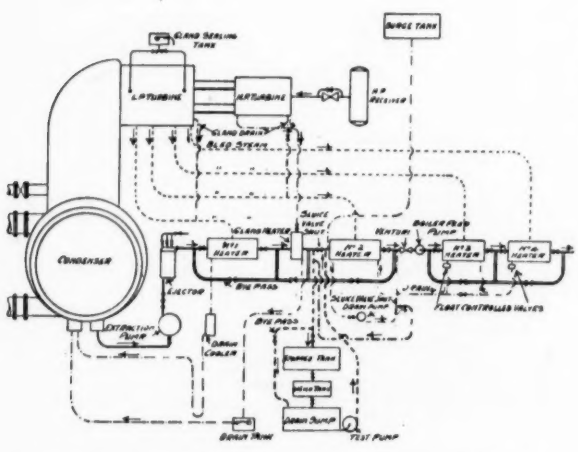


Fig. 3.—Boiler Feed-water Heating System Lay-out.

TABLE III.—Condenser Cleaning.

Method.	Brushing.	Shooting.
Number of men employed	8	9
Time taken (hours, approx.)	50	5
Average cost	£42	£8
Cost of 0.2 in. loss of vacuum :		
Turbo-generator	1-2-3	4
Economical load, kW	24,000	32,000
Coal loss with 0.2 in. Hg. below datum, lb. per kWh	0.0162	0.0134
Cost of coal per ton	14s. 3d.	14s. 3d.
Extra cost with vacuum 0.2 in. Hg. below datum per day at economical rating	£2.96	£3.28

Tests on Turbine and Feed-heating System.—The advance in practice relating to multi-stage regenerative feed-heating installations introduced new problems regarding arrangements for testing the new plant and the routine to be observed during the tests.

Fig. 3 presents diagrammatically the lay-out of the plant for normal operation, together with the special arrangements necessary for testing, such as the piping employed to and from the weighing tanks during tests.

The deductions from the results of the tests are presented in Tables IV, V, and VI. The figures relate to the actual conditions as run, no correction of any sort having been introduced to adjust the test results. In Table IV, test 3 refers to summer and test 5 to winter conditions.

It can be shown that as a result of the feed heating performed during tests 3 and 5 the steam consumption was increased by 10.94 and 11.69 per cent., respectively, over and above that which would be obtained with no feed heating. In other words, the steam consumptions corresponding to tests 3 and 5 without feed heating are 9.062 and 8.806 lb./kWh, respectively. Under normal conditions and during the tests the total load on the turbine is divided between the main and auxiliary generators; their efficiencies are therefore given separately in Table V to enable the mean efficiency under the test conditions to be determined. In Table V the turbine efficiencies are given relatively to adiabatic expansion, based on the heat drop deduced from the most recent steam tables of importance. The variation between the figures based on the work of the various authorities cited leads one to hope for an early and successful conclusion of the work of the International Steam Tables Conference held in London in July, 1929.

It should be noted that, averaging the three values of the steam conditions before the stop valve and the vacuum at the turbine exhaust, the turbine efficiency under the summer conditions of test 3 is 85.37 per cent., which figure becomes 85.78 per cent. if the heat drop from a point before the first nozzle to the average vacuum at the exhaust flange is considered. The corresponding average values for the winter conditions of test 5 are 83.99 and 84.59 per cent., respectively.

TABLE IV.—Test Deductions.

Test No.	3	5
Test steam consumption, lb./kWh	10,055	9,836
Total heat at stop valve,, B.th.u./lb.	1371.7	1364.0
Total heat of feed leaving No. 4 heater, B.th.u./lb.	286.3	281.0
Net heat supplied, B.th.u./lb.	1085.4	1083.0
Test heat consumption, B.th.u./kWh	10913.7	10652.7
Test thermal efficiency, per cent.	31.27	32.03

TABLE V.—Adiabatic Turbine Efficiencies at Economic Rating.

Test No.	3		5	
Combined efficiency of main and house service generator, per cent.	96.62		96.87	
Authority.	Stop valve. to exhaust.	Gov. valve. to exhaust.	Stop valve. to exhaust.	Gov. valve. to exhaust.
Callendar, 1930, per cent. ...	85.22	85.62	83.94	84.45
Mollier, 1929, per cent. ...	85.28	85.65	83.93	84.48
A.S.M.E., 1929, per cent. ...	85.60	86.08	84.10	84.84

TABLE VI.—Generator Efficiencies in Accordance with Specification No. 269—1927.

Load in per cent. of M.C.R.	40	60	80	100
Main generator (0.85 p.f.), per cent.	95.65	96.60	96.95	96.66
House service generator (0.90 p.f.), per cent.	89.4	92.13	93.45	94.15

Operating Results.—To enable the operating results of the extensions at Barton to be assessed, details have been analysed relating to each of the concluding six months of 1929; the seasonal variations of a year are therefore covered, but not duplicated. The fuel is rough dry slack, fine slack, and coke breeze.

The boiler-house efficiency, without auxiliaries and based on metered feed, after deducting coal for banking and starting boilers from cold, averages 80.62 per cent. for the six months. The calculated efficiency, checked approximately from flue-gas leaving temperature and its CO_2 content with a conventional allowance of 5 per cent. to cover all other losses, averages 83.8 per cent. for the six months for the boiler itself when steaming. The boiler-house losses average 3.08 per cent., and when allowance for these losses is made on the 83.8 per cent. efficiency just deduced an average efficiency for the boiler house of 81.22 per cent. is obtained from consideration of the flue-gas condition.

Based on the kWh generated for the last six months of 1929, the mean efficiency of station "A" is 20.50 per cent. with a mean load factor of 31.81 per cent.; the mean efficiency of station "B" is 23.79 per cent. with a mean load factor of 66.92 per cent.; and the mean combined station efficiency is 22.41 per cent. with a mean load factor of 52.25 per cent. These figures have been obtained when using relatively low-grade fuel having an average higher calorific value of only

11,500 B.th.u. per lb. and a high average ash content of 14.7 per cent. The influence of the calorific value of the fuel burnt and its ash content on station efficiency is not generally appreciated. The mean efficiency of engine room "A" for the six months averages 26.19 per cent., while that of engine room "B" is 30.48 per cent.

Acknowledgments.—The authors express thanks for personal assistance rendered by Messrs. S. A. Russell, G. T. Allcock, A. B. Owls, J. R. Finniecome, C. C. Lloyd, and K. Baumann. They also acknowledge information received from Messrs. C. S. Allott & Son, Babcock & Wilcox, Ltd., Richardsons, Westgarth & Co., Ltd., the British Thomson-Houston Co., Ltd., and the Metropolitan-Vickers Electrical Co., Ltd.

Power-Station Plant.

Notes of interest on the care and maintenance of main and auxiliary equipment.

By W. J. OSWALD and E. W. GREENWAY.

(*Report of a meeting of the* London Technical Group *of the* Electrical Power Engineers' Association.)

At a meeting of the London Local Technical Group of the Electrical Power Engineers' Association in March Messrs. W. J. Oswald and E. W. Greenway read a paper entitled "Some Notes on the Maintenance of Station Plant." In the early part of the paper the supreme importance of cleanliness in every direction was emphasised, as was the necessity for general and periodical inspection of switchgear, time-limit fuses, switch contacts, instruments, cables and cable boxes.

Turbo-generators should be thoroughly warmed through before starting up, and should be brought up to speed gradually, except when passing through the critical speed which, when reached, should be passed as quickly as possible. There was a tendency on the part of the running staff to have the pressure of brushes on slip rings or commutators much greater than was necessary. With regard to overhauls, for the joint between the bottom and top halves of the casing a mixture of 50 per cent. manganese and 50 per cent. foliac was recommended; where there was an unevenness in the surface due to distortion, particularly at the high-pressure end, asbestos string with a copper-wire core should be inserted. Instructions were then given as to the testing of turbine units, and the steps should be taken for ascertaining the cause of increased steam consumption.

Speaking of the cleaning of condenser tubes, it was asserted that some cleaners used under-sized brushes, which made the work easier, but was practically useless. A brass-wire brush was more effective than a steel-wire brush.

As regarded boiler units, daily tests should be made of samples taken from the water entering the boilers, and the condition of the water should be such that the results obtained showed a hardness of 0.5 deg., with a phenol test of 0.5 and a total alkalinity of 1.0. The authors had proved conclusively that if such conditions were maintained in the feed water, the amount of scale in the tubes after 12 months' steaming would not be more than egg-shell thickness, and a 50,000-lb. boiler could be cleaned out in four days. It was necessary also that the density of the water in the boiler should not exceed 600 grains per gallon, and to achieve that it was recommended that the water should be changed once a month rather than daily to blow down the boiler, say, 3 or 4 inches. When a new tube was installed, it was a good practice to paint the inside with "Apexior," which assisted considerably in keeping the tube in a clean condition. Incidentally, it was recommended that a coat of "Apexior" applied to the turbine blades would assist in preventing corrosion and in keeping the blades clean. With regard to mechanical stokers, the authors strongly advocated the practice of making one man responsible for maintaining the lubricating system in an efficient condition. It was a mistake to allow a grate to run after it had commenced to bind on the sides, as considerable damage might be done to the driving gear, and, in running, frequent stoppages would occur, causing difficulty in maintaining proper steam pressure.

In connection with steam-turbine-driven feed pumps, the importance of fine clearances was emphasised, and the necessity for having a system whereby the essential clearances were checked at regular and frequent intervals was advocated. Dealing with the maintenance generally of centrifugal pumps, surprise was expressed that a number of manufacturers supplied a design of gland in which the end of the neck bush and the end of the gland were square with the shaft. It was necessary that those parts should be chamferred off, so that when the gland was tightened up the packing would be pressed down on to the spindle.

The view was also expressed that it should be the responsibility of one man to keep the motors of auxiliary plant in a clean and reliable condition, it being pointed out that the breakdown of even a small part of the auxiliary plant might place a turbo-alternator or a boiler unit out of commission, or considerably restrict its duties. The paper also contained some useful information with regard to the maintenance of pipe work.

On superheated-steam pipe lines brass joint rings should not be used; a cuprous-nickel ring of 80 per cent. copper and 20 per cent. nickel had been found the best to withstand superheat. The use of ordinary screwed and socketed joints, however small, for steam pressure pipes was strongly deprecated, while in the smaller-sized pipes the use of adaptable unions was recommended. Special emphasis was laid upon the need for close attention to valves. A frequent cause of valve spindles being hard to operate was their being allowed to get into a dirty condition, and that particularly applied to valves fixed in a horizontal position.

The authors also had a word for the manufacturers of plant, and pointed out to designers how necessary it was that they should give full consideration to facilities for easy dismantling of the plant, so that repairs could be quickly effected and a thorough overhaul carried out expeditiously and economically.

Discussion.

Mr. Carr suggested that in the future the control-room gear would take the form of a very small board, about 5 or 6 ft. long; the whole of the control apparatus would be operated on the main control panels some distance away. He believed the idea had been taken up in America. A type of control panel which ought to be adopted was one making use of a map system, by which a man sitting in front of the board could see how the controls were operating. He regarded evaporators as absolutely necessary with modern plant, but he would never put in a boiler with a cap on it if he were a chief engineer. No mention had been made in the paper of inclined stokers, of which he had had some disastrous experience. After advocating the use of smoke indicators on boilers, Mr. Carr referred to recent improvements in the belts of coal conveyors, and mentioned the use of rubber in that connection.

Mr. B. Samuels said there was still a good deal of room for improvement in power stations as regarded cleanliness. There were power stations not far away in which it was a real pleasure to walk about on top of the boilers. The result was that the valves were kept in proper condition and the staff took a pride in the plant. There had been developments in the design of chain-grate stokers recently which went a long way in removing the difficulties with regard to the growth of links. Moreover, there were many chain-grate stokers which had been in use for many years in which the links were still in perfect condition. In the newer types of stoker there were no side wheels, and therefore difficulty in that direction was avoided.

Mr. Lindsay said there were stokers of the reciprocating-bar type to-day giving 50 per cent. overload.

Mr. A. Nunn did not think that with up-to-date water-tube boilers it was necessary to warm up the turbines, although it was always done with marine-type boilers.

Mr. W. Cornet spoke of the need for greater accessibility of overload valves. In the case of the two types which he knew, it was necessary to put in half a day's work to draw the lagging off before the valves could be got at.

Mr. A. Ponson referred to "Fescolising" rotor spindles and other worn parts; this was a cold process of the electro-chemical deposition of metals which ensured absolute adhesion between the base metal and the metal deposited, which could be nickel, copper, chromium, cadmium, cobalt or lead. In many cases it had been possible to get four and a half times the life with a "Fescolised" part.

Mr. Laming did not think that once per shift was often enough to operate soot blowers; in his case they were operated three times per shift.

Mr. H. J. Bennett said the question of feed water was becoming very important, and a more continuous system of testing was necessary. At one station each set had a water service taken from the condensate discharge; periodic tests were made by chemists, and from those tests the engineer knew what to expect.

Mr. Oswald, replying to the discussion, said the real object in presenting the paper was to promote a discussion which would be of assistance to the young engineer. With regard to the running up of turbines, the main purport of the remarks in the paper was to ensure that turbines were run up slowly. He had had quite good experience of "Fescolising," and in one case a turbine pump shaft which had been "Fescolised" had shown a temperature drop of 40 to 50 deg. F. from what it was before undergong the process.

An 1830 Dynamo.

The Hungarian Society of Natural Science has organised for its 90th anniversary an interesting exhibition of portraits of the leading Hungarian scientists of the last century, together with their original manuscripts, correspondence, and descriptions of their achievements. One of the most interesting exhibits is an electric dynamo constructed by the Hungarian inventor, Anyos Jedlik, more than a century ago.—*Reuter's* (Budapest).

The Ideal Home Exhibition.

A Review of the Electrical Features.

(*Concluded from page 660.*)

A FEATURE of the general illumination of the Ideal Home Exhibition this year are fan-shaped wall lighting fittings (fig. 5), manufactured by Messrs. Wm. McGeoch & Co., Ltd., to the design of Mr. Douglas G. Tanner, F.R.I.B.A. These are 34 in. long and 2 ft. in diameter, and

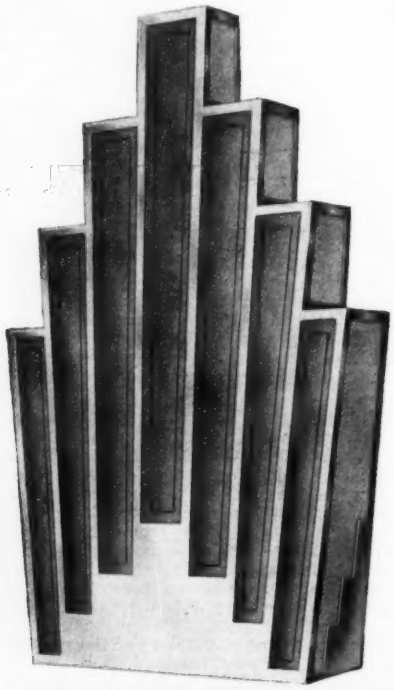


Fig. 5.—General-lighting Fitting by W. McGeoch and Co., Ltd.

are made in finished aluminium. This company is also responsible for the special electric lanterns employed. The scenic illumination has been provided by the British Thomson-Houston Co., Ltd., while the wiring for this particular form of lighting has been carried out by the Strand Electric and Engineering Co., Ltd

Domestic Electrical Appliances.

The stand of the Hotpoint Electric Appliance Co., Ltd., is divided into three sections: vacuum cleaners, cookers, &c., and washing machines. In the vacuum-cleaner section are being demonstrated the "Premier Duplex" and the "Premier Junior" machines, each of which is fitted with a motor-driven brush. A range of the new series of "Hotpoint-Falco" cookers is being exhibited and demonstrated; these embody all the latest desirable features in connection with the design of cookers, including mottle-grey enamelled hobs, removable oven interiors, and doors to the grill chambers. A full range also of "Hotpoint" appliances, such as irons, toasters, and coffee percolators, is on view. Particular attention is called to the "Hotpoint Super Automatic" electric kettle, figs. 6 & 7, which is fitted with the patent "Calrod" sheath wire element actually immersed in the water, so assuring a high efficiency. The element is protected by the "Hotpoint" thermal switch which prevents the kettle boiling dry should it be left in circuit without water in it. The switch operates automatically and needs no attention.

The washing-machine section is devoted to the demonstration of the "Hotpoint-Maytag" machine, which operates on the "gyrafoam" principle, and ensures a very rapid washing of the clothes, so that no hand rubbing is necessary. This machine only occupies a floor space of 25 in. square. The tub is constructed of cast-aluminium. An electric ironer, also on show, can be attached to the washing machine by simply removing the wringer from the wringer post and replacing it by the ironing attachment.

The display of Kelvinator, Ltd., includes the new 1930 line of "Super-Automatic" electric refrigerators for every kind of home. All of these cabinets possess "Ice-O-Thermic" tubes for producing ice cubes quickly. In the "De Luxe" models, *four* different temperatures are maintained, each directed and controlled to perform a distinct service without disturbing the others. The new machine performs all of these functions, yet remains wholly automatic and retains its features of economy and simplicity in use. Cold rooms of 150 cu. ft. and 40 cu. ft. capacities are also exhibited, in addition to a display counter for grocers, &c.

A new model vacuum cleaner is shown for the first time on the stand of Electrolux, Ltd. It is very quiet in action, and its suction is increased by 40 per cent. Air purification is effected by means of a pad through which air is drawn from the room and sent out again clean and purified. The "Electrolux" silent, motorless refrigerator and the floor polisher are other interesting items on this stand.

Three models of its electric cleaner are being shown by Hoover, Ltd. They include the 'Minor," a vacuum cleaner relying on suction alone, the compactness of which will appeal particularly to the owners of smaller houses and flats.

It is particularly interesting to learn that whereas last year "Radiation" gas plant makers secured the business for the cooking and heating equipment in the Tudor House, this year in this exhibition a "Creda" electric cooker and several "Creda" fires are installed.

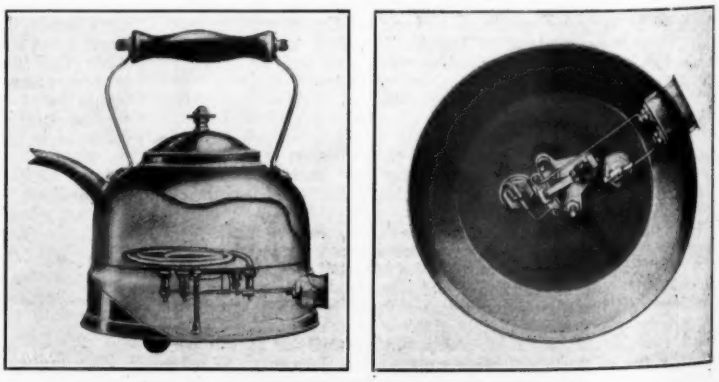
Messrs. A. Bell & Co., Ltd., are displaying a tiled fireplace with a built-in electric fire. There is no visible metalwork, excluding, of course, the element, and the whole is in one unit and can be fixed against a flat wall.

On the stand of Bankside Investment Trust, Ltd., a number of "P.H." (electric warm air) convectors are displayed incorporated in various articles of furniture, and also the "Everlite" lamp.

The exhibit of Beatty Bros., Ltd., consists of a "Model Home Laundry" in which various electrical domestic appliances are being demonstrated. The Stokes Table Cooker Co. is showing the appliance of that name.

An "Electric Tap," fig. 10, is a feature of the display by Sloan Electrical Co., Ltd. This is of very robust construction and is suitable for use on a.c. and d.c. supplies at 200/250 V. It is claimed that the heating element is practically everlasting, and that there is no loss of heat through radiation, the tap itself remaining cold, even after many hours of consecutive use. The control is by means of a handle which is operated with one hand; either hot or cold water is supplied at will, and the current switched either "on" or "off" with one movement. The following are claimed to be exclusive features of this appliance: a valve which can adjust the instrument to any pressure of water; no possibility of lime deposits, the current being cut off before the water stops running, so that the following flow of cold water immediately disintegrates any deposit; the inside of the tap is specially nickelled, which keeps it absolutely clean.

A tastefully-decorated kitchen on the stand of Messrs. Falk, Stadelmann & Co., Ltd., provides the environment for demonstration in operation of modern models of electric cookers; grillers; hot plates; irons; toasters; coffee percolators; vacuum cleaners; washing machines; and other domestic articles which can be run electrically for time and labour



Figs. 6 and 7.—"Hotpoint" Super-automatic Kettle; Disposition of Element and "Safety" Switch.

saving. "Efesca Morganite" combined heating and lighting units form a feature on the stand. These units appear to be just the ordinary panel lighting units, but the light effect is combined with radiators which give intense heat, and have

a very pleasant appearance. This combination of "Efesca" fittings with the "Morganite" heating panels heralds a new vogue in combined lighting and heating units which will no doubt find increasing favour in the application of dual service propositions for public lighting.

The new "Efesca" clothes washer, fig. 8, is another exhibit of interest. This machine is claimed to be unique, as

Fig. 8.—"Efesca" Washing Machine.

it can be operated in the smallest of sculleries—in fact, in a cupboard. All that is necessary is to put the washer into a tub containing the clothes. A suitable bracket on the side of the machine provides for fixing the washer to the side of the tub. The machine works entirely on a new principle. It drives a powerful jet of hot suddy water through the fabric in a swirling, tumbling action. No mechanical parts touch the clothes, the operation depending on water action alone. The loading of the motor is 250 W.

The main exhibit on the stand of Sadia, Ltd., is an automatic electric storage water heater. The tinned-copper container of this appliance is provided with very efficient heat insulation, and is enclosed in a white-enamelled metal container. A thermostat is fitted into each heater and automatically switches off the current when the water in the heater has attained a temperature of 195 deg. F. This company has now introduced a special ball tank which can be attached to the top of the 11- and 16½-gal. models. This is giving excellent results, and is free, it is claimed, from the objection to which self-contained ball-tank water heaters have formerly been subject. This construction uses the

Fig. 9.—"Sadia" Table Cooker.

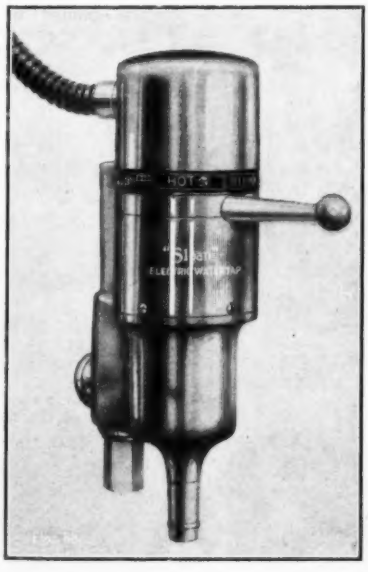


Fig. 10.—Electric Hot-water Tap.

standard water heater, the cold water supply being given by an external pipe from the ball tank mounted on the top of the heater. The radiation losses are considerably reduced for this type of tank, and the rate of flow is such that from two to three gallons of water per minute can be obtained from the heater. No restricted outlets or inlets are used, so that the tank can be employed on even the hardest water without any danger of "furring" up.

Another exhibit is the new "Sadia" table stove, fig. 9, which has been specially designed to meet the demand for a cheap and efficient table cooking apparatus. Three-heat regulation is effected by a special plug instead of a switch. An aluminium deflector plate prevents the heat from spoiling the table, and enables the stove to be used anywhere with safety. The body and legs are fire white-enamelled, while the boiling plate is of the makers' usual high-speed quality. The apparatus is made in five sizes with loadings varying from 400 W to 1,400 W.

Messrs. Duncan Watson & Co. have a general display of electric labour-saving appliances, including the "Rotarex" renovator of the enclosed-dust-bag type, the new "Apex 58" motor-driven revolving-brush cleaner, and the "Apex 43" straight-suction type cleaner. In laundry equipment the company is showing "Rotarex" and "Apex" washing machines of both the "gyrator" revolving-cylinder, and the new combined "gyrator" and hydro-extractor types. Ironing machines are represented by both the "Apex" and "Rotarex" portable folding ironers, and the "Rotarex" 46-in. double-roll ironer. On this stand is also shown a range of electric floor polishers, electric health motors, a range of electric light fittings, and a new and exclusive form of "Muralite" panel lighting.

Radio and Telephone Equipment.

To the radio-set constructor, some very interesting components are being exhibited on the stand of Igranic Electric Co., Ltd. These include inter-valve transformers, h.f.

Fig. 11.—The "Neutrosonic de Luxe" Radio Gramophone Receiver.

chokes, l.f. chokes, power transformers, high and low resistances, volume controls, grid leaks, valve holders, variable condensers, fixed and semi-variable condensers, "Q.M.B." switches, midget switches, "Pentoformers," slow-motion dials, and numerous other "Igranic" components. There are also articles for use in connection with radio-gramophones, including the "Phonovox" pick-ups in three different models, and the "Phonomotor," a first-class electrically-driven gramophone motor suitable only for a.c. mains. A feature of the display is the "Igranic" seven-valve "Neutrosonic" receiver, de luxe model, fig. 11, which is shown in a neat and attractive mahogany cabinet. Two models of this receiver are being exhibited, one with an electrical gramophone complete, and one without. Among the various mains-operated receivers that may be seen is the A.C.3 receiver, which is fitted with a new self-contained frame aerial. A supply unit is also included, which delivers the h.t. and l.t. current without any necessity for voltage adjustments. A loud-speaker is built into the cabinet. Another interesting mains receiver is the A.C.3 table model, in which is incorporated a supply unit to provide ample h.t. and filament-heating current to the valves. The "Igranic" A.C.2 receiver is designed and produced as a "local" station set, but under reasonably favourable circumstances it is possible to receive many other stations. The receiver embodies a mains supply unit, which is suitable for working off a.c. mains only, and it supplies ample h.t. and filament-heating current for the valves. To those interested

in gramophone reproduction, the "Igranophone" G.2 equipment is of unusual interest. This consists of a double gramophone turntable, fitted with "Phonovox" electrical pick-ups and an "Igranic" Phonomotor.

The Reliance Telephone Co., Ltd., is giving an impressive and interesting demonstration of the merits and adaptability of the automatic exchange telephone system, having staged on its stand a comprehensive exhibit of practically every kind of telephone apparatus and material, all of British manufac-

Fig. 12.—"Reliance" Loud-speaking Telephone Unit.

ture, to meet the requirements of, not only commercial houses, but also of clubs, flats, hospitals, and private houses. The G.E.C. automatic private exchange telephone systems are represented on the stand by 25-line and 50-line units, but larger equipments are, of course, made by the company. All connections by this system are automatic; the services of an operator may be entirely dispensed with, so that absolute secrecy in conversation is ensured. The "Reliance" loud-speaking telephone, fig. 12, is shown for the first time. This instrument enables an executive to communicate with any member of his staff merely by moving a key and speaking in a normal tone; all replies are heard through a loud-speaker, A small receiver fitted at the side of the instrument automatically cuts out the loud-speaker if necessary. Indicators are fitted to show the department calling. The outstanding features of the instrument are that an executive has both hands free while telephoning. Conversation can be carried on from any part of the room, and secret communication is also provided.

On its stand, the Mullard Wireless Service Co., Ltd., has adopted a rich scheme of decoration in dark oak, with royal-blue hangings and shaded lights to furnish a suitable setting for "Orgola" receivers and pure-music speakers, which are picked out by concealed spotlights. An additional attraction is a kinematograph display, while the front portion of the stand is dressed with a general display of P.M. valves, pure-music speakers, P.M. high-tension supply units, and filament transformers, "Permacore" l.f. transformers, P.M. wire-wound resistances, fixed condensers, grid leaks, and other accessories. The popular "Mullard" girls are distributing to the public copies of a special "Ideal Home" edition of the company's publication "How to get Better Radio."

The following items are among the exhibits of Ferranti, Ltd.: a.c. mains receiver, model 31, in oak, walnut, and mahogany; electro-dynamic speakers, both a.c. and d.c. types, in oak, walnut, and mahogany, and also in their chassis form; a permanent-magnet dynamic speaker chassis; pedestal-type dynamic speaker; and a combined a.c. mains receiver and speaker console. In addition to the foregoing, there is a selection of "Ferranti" radio components, including trickle chargers and motor-car battery chargers. A technical staff is available to answer queries of all kinds.

The Marconiphone Co., Ltd., instead of having the usual open-type of stand, has erected a sound-proof demonstration hall wherein, under conditions of comfort, visitors can listen to an interesting short lecture on broadcasting, followed by a recital of selected musical items reproduced through Marconiphone apparatus. On the counters outside this demonstration room a complete range of "Marconiphone" products is on view, and competent assistants are in attendance to furnish visitors with information.

On the stand of the Edison Swan Electric Co., Ltd., in the wireless section, is displayed "Mazda" radio valves and various components and sets.

There is a very representative display of radio apparatus by the General Electric Co., Ltd., embracing "Gecophone" battery-operated receiving sets, mains-operated sets, portable sets, high-tension power units, sundry radio components, and "Stork" loud-speakers, while "Osram" valves and "Magnet" h.t. batteries figure in contiguous displays.

On the stand of Messrs. Falk, Stadelmann & Co., Ltd., is to be seen as excellent display of "Efesca" wireless sets and loud-speakers.

On the stand of the Telephone Development Association may be seen an easily portable demonstration set designed for use in the instruction of schoolchildren in the proper use of the telephone. It consists of two modern dial telephones, as supplied by the Post Office, an ample length of flexible lead to permit of conversations being carried on from either end of a large classroom, or in adjacent rooms, and a powerful battery to operate the instruments. The Association possesses thirty of these sets, which it is prepared to supply, in turn, free of all charge, to education authorities who make application for them. With the sets will be supplied a local telephone directory, a short suggestion—prepared by the Association in conjunction with the Post Office—for a lesson on the use of the telephone, and full non-technical directions for assembling and using the apparatus. The assembly is a matter of seconds; ordinary terminal screws connect the lengths of flex with the telephones and the box containing the battery of fifteen cells. An ordinary electric-light switch turns on the current, and a proper use of the dial sets up the connection. Conversation can then be carried on. A small addition to the usual desk set is a tiny glow lamp on the base of each telephone. This is for the purpose of showing the actual passage of the current along the circuit when the receiver is lifted and when the dial is operated. The set will enable pupils to be taught the proper use of either the manual or the automatically-operated telephone. Mr. Powell-Jones, director of the Association, is prepared to visit the chief centre of any educational district using the apparatus, and to give an explanatory talk to the teachers.

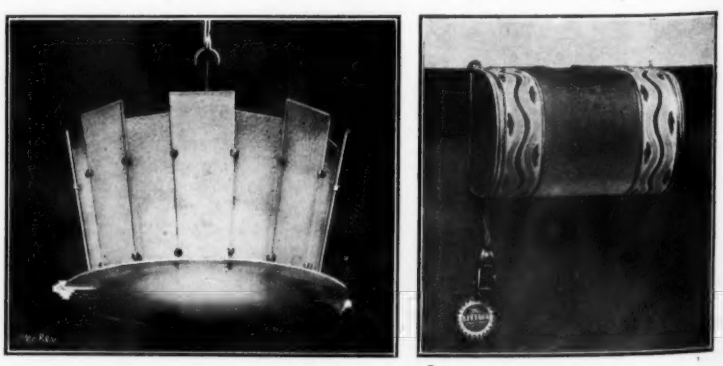
Messrs. S. G. Brown, Ltd., are showing a full range of their radio instruments, including receivers specially built for power, quality of tone, and selectivity.

Among the many other companies displaying excellent examples of radio apparatus may be mentioned Regent Radio Supply Co.; Burndept Wireless (1923), Ltd.; Benjamin Electric, Ltd.; A. G. Cossor, Ltd.; Dubilier Condenser Co. (1925), Ltd.; Celestion, Ltd.; Aeonic Radio, Ltd.; and the Brownie Wireless Co. of Great Britain, Ltd.

Electric Lighting Apparatus.

Some excellent examples of electric lighting are to be seen in the buildings in the housing section, and it is interesting to note that in the Frewen cavity-brick house all the lighting fittings were supplied by Messrs. Siemens Electric Lamps and Supplies, Ltd. The kitchen, downstairs lavatory, and bathroom are equipped with white-enamelled "Silveray" fittings, and white-enamelled "Sanaray" fittings are provided for the maids' and upstairs lavatories. "Siemens" decorated pendants serve for the hall and landing, while the dining room is equipped with a hexagonal oxidised-copper "Corona" fitting and an oak floor standard. In the living room there is a combination of lighting by means of special panel pendants, with brackets to match, and a floor standard with a shade designed to match the pendants. In the two principal bedrooms the general lighting is by means of 1- and 2-light counterweight pendants, with silk shades, and table standards; this lighting is augmented by bedlight trough shades. The smaller bedroom is lighted by means of three wall shades made in gold-coloured "Celestaloid."

Louis Dernier & Hamlyn, Ltd., are again displaying the "Litlux" bed light and their "Neolux" glass panel fittings. The demand for the former is rapidly increasing, and a new range of attractive models has been produced. Several new



Figs. 13 and 14.—"Litlux" and "Neolux" Lighting Units.

models of the latter fittings have also been created, including some delightful new table standards. Figs. 13 and 14 show typical examples of the latest fittings.

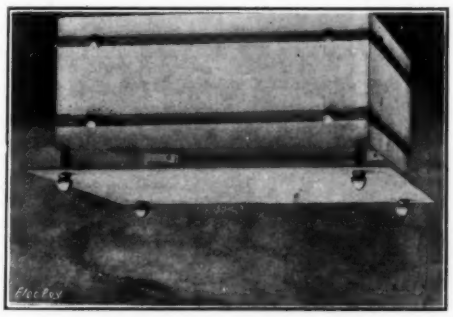
A prominent sign under the facia board on the stand of Messrs. Falk, Stadelmann & Co., Ltd., calls attention to "The House for Light," which is probably one of the most brilliantly lighted exhibits in the electrical section. The

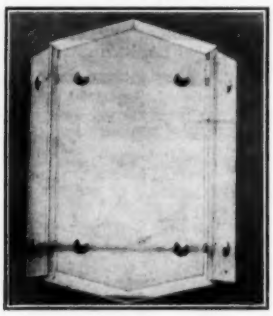
modern panel-type pendants and wall brackets, with exquisitely tinted or etched and engraved glass in conjunction with the metal craftsmanship, show the ideal combination of the creative artist and the skilled craftsman . Interspersed with the modern art fittings are shown several examples of lighting units suitable for period rooms, and floor and table standards with suitable shades are shown in such a manner as to please the most fastidious taste.

The function of light as the enricher of beauty is charmingly demonstrated by a tableau on the stand of the British Thomson-Houston Co., Ltd. The figure, intensely lighted by a concealed projector, turns slowly, stops, then turns again. The curtains behind part and disclose a star-lit backcloth against which the ballerina stands out in delicate relief. Over four hundred "Mazda" lamps of various sizes and colours are used in the display, the majority of them being installed under the floor in the foreground. These lamps are automatically controlled by a four-circuit dimmer. The total connected load is about 22 kW. The tableau, based on the company's well-known advertisement, "Beauty enriched by Light," is an object lesson in the use of light for interior decoration.

The Sheringham Daylight Co. is showing two new "corrective" reading lamps; one is specially designed to add attractiveness to its utility feature, and the other is a desk lamp finished in mahogany and fitted with a 60-W lamp.

In "The House that Jill Built," the electrical contractors for which were Messrs. Francis Polden & Co., Ltd., may be seen some unusual, but pleasing, lighting fittings manufactured by Messrs. Best and Lloyd, Ltd. Two examples are those depicted in figs. 15 and 16. The ceiling fitting is designed for four lights and constructed with obscured rimpled panes, with basis brass finishes. It is 6 in. deep by 14 in. sq. The wall fitting is described as a one-light wallplate, 8 in. by 6½ in., with a 3½-in. projection. It is constructed with obscured plate panes, with a clear bevelled front pane.





Figs. 15 and 16.—"Best & Lloyd" Fittings in "The House that Jill Built."

Small Generating Sets.

Petters, Ltd., are showing three varieties of their small sized electric lighting plants, suitable alike for the farm, home, shop, or factory. The first is a belt-driven "Petter-Light" set comprising a 3-b.h.p. universal petrol and paraffin engine with a 50-volt dynamo on a combined baseplate, complete with a neat switchboard, and a battery. The output of the dynamo is 1,250 W, and the battery has a capacity of 100 ampere-hours. The "Auto-Petter-Light" plant supplies electricity whenever desired at the touch of a switch, no storage batteries being required. The engine is a 2-b.h.p. model, 1,000 r.p.m., 950 watts, 110 volts. It possesses an improved type of controller, which, it is claimed, is not liable to derangement of mechanism. This set plant is entirely self-contained. The "Alpha Petter" electric lighting plant is a small-sized lighting set consisting of a 1½-b.h.p. universal engine running at 750 r.p.m., belt-driving a dynamo, 750 W, 32 V, with a battery capacity of 50 Ah. These sets are each very compact, and may be accommodated in any convenient outhouse or cellar.

Frigidaire, Ltd., are showing a new range of "Delco-Light" equipment, including several lighting sets, with and without batteries, ranging in output capacity from 800 W to 2,500 W, and also electrically-driven water-service systems for working in conjunction with shallow and deep wells.

The principal exhibit of Kohler Co., Ltd., is one of the company's new 220/230-V automatic generating sets which are now standardised, so as to be serviceable when the grid scheme arrives. The machine is erected in such a way as to reproduce actual running conditions, and demonstrations of its automatic operation are being given.

Messrs. Thorn & Hoddle, Ltd., have a very comprehensive exhibit in conjunction with their associated company, Messrs. J. Wontner-Smith Gray & Co., Ltd. On the electrical side there is a "Pelapone" direct-coupled 1-kW set, with battery and switchboard, in operation, and a 5-kW set of the same make. For those who favour the automatic type there is a "Kohler" set running. Accessories for electricity supply, such as brackets, pendants, standards, radiators, &c., are there in good variety.

Messrs. R. A. Lister & Co., Ltd., are showing a number of house-lighting sets, including a 1-kW fully-automatic equipment, 110-V, complete with a portable light-load battery. A direct-coupled electrically-driven pumping set capable of delivering 330 gal. per hour to a head of 110 ft. is another feature of this display.

The "Electolite" fully automatic lighting set which is being displayed by Messrs. Boulton & Paul, Ltd., starts from a small battery when three or more lamps are switched on, and stops when two are left on.

Miscellaneous Items.

In the "Hall of Music" the Gramophone Co. has a brilliant display to demonstrate the latest developments in gramophone reproduction of the world's masters of music. Around the Hall the latest H.M.V. models, including the radio-gramophone and the automatic electrical reproducer, are demonstrated by experts.

A large number of electric clocks, with all the pendulums in accurate synchronism, form an impressive display on the stand of Bulle Clocks. The clock is driven by a small dry battery, which it is required to renew every two or three years.

A giant-scale map of the world displayed by the British Horo-Electric, Ltd., in co-operation with the *Daily Mail*, has "Bulle" clocks inset in the positions of about 45 of the principal cities in the world, giving the relative times in those cities. All the clocks are synchronised, and are working from a single 1½-V battery.

Thermega, Ltd., have an interesting display of electric blankets and warming pads fitted with thermostatic control. This equipment is made by disabled ex-Service men.

Some interesting examples of ultra-violet-ray quartz lamps are to be seen on the stand of the British Hanovia Quartz Lamp Co., Ltd., including the "Homesun" lamp for home use, "Analytic" lamp for testing purposes, and the "Alpine Sun" lamp for hospitals, &c.

In the Refrigeration Section excellent displays by the Edison Swan Electric Co., Ltd.; Marco Refrigerators (1929), Ltd.; and other manufacturers of cold-producing machines are to be seen.

The "Atalanta" screw-driver, chucks, drilling jigs, &c., are being displayed by the Atalanta Company.

The E.A.W. at the Exhibition.

On Thursday last week about 400 members of the Electrical Association for Women visited the Ideal Home Exhibition on the invitation of the General Electric Co., Ltd., and were entertained at luncheon at the Clarendon Restaurant, Hammersmith. Mr. M. J. Railing, joint managing director of the G.E.C., presided at the luncheon, and in proposing the toast of the guests, said that the fact that the Association's membership had grown to 4,000 in the past two years was a wonderful indication of the emancipation of women. He said that there was an increasing realisation of what could be done by means of electric light. As far back as 1910 the General Electric Co., Ltd., had realised the possibilities and had instituted an Illuminating Engineering Department. He claimed that England was producing better electrical commodities than any other country, and even if the original cost was sometimes a trifle higher, the safety and reliability of British appliances justified it.

Mrs. Wilfrid Ashley, president of the E.A.W., responded, and in thanking the company for its hospitality, said that the G.E.C. Pavilion of Light at Olympia was an object lesson in the use of electricity for lighting. She paid a tribute to Miss Caroline Haslett, the director of the Association, to whose efforts the success of the movement was principally due. She hoped that the membership would continue its rapid growth, and that there would be an increasing use of electricity in the home.

During the afternoon small parties were shown over the Ediswan Hall of Ideals and afterwards the Edison Swan Electric Co., Ltd., entertained the ladies at tea.

The members came from various parts of the country. The London branches sent a large contingent and parties travelled up from Birmingham, Cheltenham, Cardiff, Ashford, Rugby, Gloucester, and Bristol.

Mersey Docks Model.

A scale model of part of the River Mersey and docks has been made for inclusion in the British section of the Antwerp Exhibition this month. Eighteen-inch models of famous liners, drawn by electric magnets under the water, pass up and down the river and come to rest in the docks; lock gates open and close automatically, and even the rise and fall of the tide are reproduced to scale. The whole of the ingenious outfit is electrically operated. It was exhibited in London by Messrs. Partridge's Models, Ltd., before being sent over to the Continent.

New Electrical Devices, Fittings, and Plant.

Readers are invited to submit particulars of new or improved devices and apparatus for publication in this section.

A Flexible-Cable Protector.

The "Ashton" flexible-cable protector and electric lamp saver, fig. 1, is a recent invention designed to prevent flexible wire from breaking just above the lampholder during the handling and cleaning of shades and when switch-lampholders are in use. The spring, besides protecting the flexible, serves another useful purpose; it is a anti-vibrator, and saves the lamp filament from damage by vibration and shock. The bushed adaptor at one end of the spring is detached and pushed through the brass cord-grip of the lampholder (the wood portion being dispensed with), and then re-attached to the spring. A short length of free flexible should be provided either inside the top of the lampholder or the spring to allow the spring to function. The new cord-grip with an ebonite clamping screw at the top end of the spring is a special feature. The inventor and supplier of this device is Mr. Harold Ashton, A.M.I.E.E., 8 and 10, Bulls Head Chambers, Market Place, Manchester.

Fig. 1.—"Ashton" Flexible-Wire Protector.

Fig. 2.—The "Generometer."

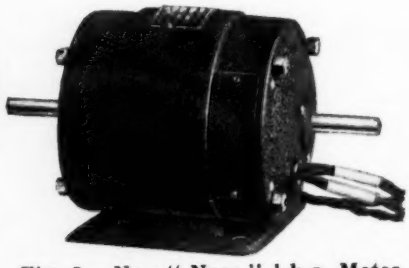


Fig. 3.—New "Neco" ⅛-h.p. Motor.

A New Small-Power Motor.

It will probably interest our readers to know that Normand Electrical Co., Ltd., 3, North Side, Clapham Common, S.W.4, are now making an all-British universal motor which has a number of novel and interesting points of design. The makers had not previously made motors of less than ¼ h.p., but a great number of inquiries led them to produce the present machine, which continuously rated at ⅛ h.p. at 2,800 r.p.m. The new "Neco" motor, fig. 3, is unique in that it is built entirely of pressed-steel, without a single casting in the machine. By thus doing away with all machining costs (except for the shaft) it is possible to use heavy double-row ball bearings, a very large diameter commutator, large brushes, &c., and to wind the armature with double-silk-covered wire, while keeping the cost of the motor very low indeed. A pressed-steel frame is also very much lighter than a cast-iron, or even a cast-aluminium, one; the complete motor weighs under 13 lb. A trouble-saving refinement is the drip-proof enclosure, which is common to all "Neco" designs. The new motor is claimed to comply with B.S.S. 170/1926 in every respect. The motor is wound for 100/110, 200/220, or 230/250 volts, 25-60 cycles. Separate windings are provided for a.c. and d.c., and the performance on a.c. is claimed to be almost exactly equal to that on d.c.

A Small-Armature Test Set.

The "generometer," fig. 2, a recent introduction of Runbaker Motor & Electrical Accessories, Ltd., Magneto Works, Ardwick, Manchester, is a small compact instrument that enables an unskilled person to locate faults in small armatures such as are used on small electric drills, vacuum cleaners, automobile generators, self-starters, and so on. The instrument is of the moving-coil pattern, reading in millivolts.

A New e.h.p. Cable Joint.

In order to avoid those troubles peculiar to e.h.p. cable joint boxes, the general policy in the past seems to have been to make the boxes as large as possible, so that the extravagance of clearance, &c., might counteract carelessness in assembly. Research, inspired by the call for ever higher transmission voltages, left the e.h.p. joint behind to some extent, and concentrated its efforts on the super-pressure cable and joint; but now that the development of the grid system is increasing the use of e.h.p. cables, the cable manufacturers are giving more attention to the neglected e.h.p. joint. The principle adopted in the construction of the new "Henley" standard e.h.p. multi-core cable joint of Messrs. W. T. Henley's Telegraph Works Co., Ltd., Holborn Viaduct, E.C.1, is the employment of uniform insulating material, *i.e.*, the jointed conductors are insulated with impregnated paper which is uniform with the impregnated paper insulation of the cable itself. Lengthy and painstaking experiment produced a satisfactory method of applying this paper insulation. A central separator of impregnated paper is inserted between the jointed cores, and a binder of the same material is applied overall, which, on being tightened up, presses the cores into their respective places in the separator. The arrangement, which is shown in the cross sectional elevation in fig. 4, provides an insulating baffle between the cores, and with the overall binder the total enclosure of each core is effected. Any risk of ionisation of air entrapped in the separator is safeguarded against by means of a metal screen provided in the centre of the separator itself. A lead sleeve encases the joint and is plumbed to the cable sheaths, the whole being protected by a cast-iron shell, not so small as to skimp clearances, and not so large as to be bulky and troublesome to handle. A handy book (U.D.A.1), published by Henley's, illustrates pictorially each progressive stage in the making of the joint. It is instructive and should prove useful to every electrical engineer interested in e.h.p. cable jointing.

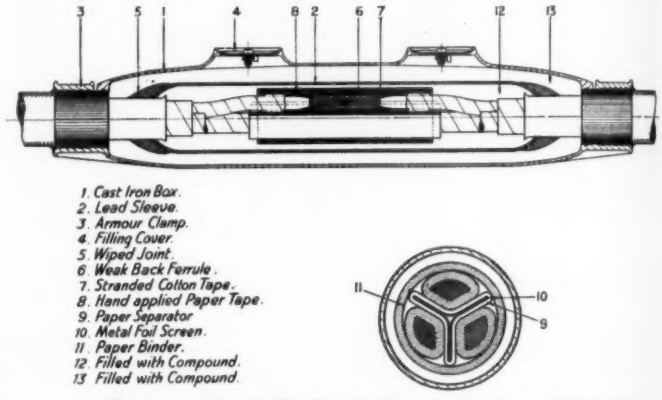


Fig. 4.—The "Henley" Standard e.h.p. Cable Joint.

A New Battery.

The Ever Ready Co. (Great Britain), Ltd., Hercules Place, Holloway, N.7, has recently introduced a new radio dry battery, 60 volts, suitable for 20/25 milliamperes discharge. It is constructed of 40 extra-large cells, and will, it is claimed, provide approximately 40 per cent. greater service than the company's popular "power" series. The tappings are arranged at 15, 27, 39, 51, and 60 volts, and the overall dimensions are 13¾ in. long by 5¼ in. wide by 3¾ in. high.

Central Electricity Board.

The second annual report of the Central Electricity Board has been published, and may be obtained, price 5s. net, from the publishers, Messrs. Whitehead Morris, Ltd., Tower House, Holland Street, London, S.E.1, or through any bookseller.

The Hardness of Electro-deposits.

An outline of the results of recent research into the causes and effects of the processes involved.

(*Extracts from a paper read before the* Electroplaters' and Depositors' Technical Society.)

THE enlightened paper on the hardness and the polishing of electro-deposits by Messrs. D. J. Macnaughton and A. W. Hothersall, of the Research Department of H.M. Arsenal at Woolwich, provoked a lively discussion. A good deal of confusion has been associated with the subject, and the authors attempted to clarify prevalent misconceptions in the light of the most recent investigative work.

Hardness Tests.—In view of the drawbacks of scratch tests the authors preferred to employ the Brinell hardness test wherever possible, it being more reliable than the more easily applied sceleroscope test. The Brinell test at present necessitated the deposition of comparatively thick coatings, but the thickness necessary to obtain accurate results which were not likely to be influenced by the hardness of the basis metal could be calculated. Furthermore, the results obtained by the Brinell tests were not liable to instrument error, and thereby enabled strict comparison to be made.

Comparison of the results of such hardness tests of electro-deposited metals with those of the same metals when produced by the usual metallurgical methods indicated that, whilst in general no great difference existed between the order of hardness in both cases, certain notable exceptions indicated the peculiar properties of electro-deposits. Thus, for example, chromium deposits had an extremely great hardness, reaching that of fully hardened alloy tool steels, yet recent work had shown that this metal, when prepared in pure form by metallurgical methods, had a hardness not greatly different from that of copper. Nickel metallurgically produced had a hardness of the order of that of mild steel, whereas electro-deposited nickel might have a much greater hardness. The wide range of hardness obtainable by suitably adjusting the conditions of electro-deposition of a particular metal was of considerable importance. It would appear that full advantage of the possibility of controlling the hardness of electro-deposited metals could only be obtained by comprehensive investigations into the influence of the various factors involved in electro-deposition upon the hardness of the deposit as quantitively determined by a reliable method, such as the Brinell test.

Abrasion Tests.—With a view to the rough classification of the wearing properties of deposits when abraded by emery, tests had been carried out by the authors which indicated that, although no relationship had been established between Brinell hardness and resistance to wear, deposited metals fell into approximately the same order when classified according to their resistance to abrasion as when arranged according to their Brinell hardness number.

Polishing Process.—Previous investigators had showed that an essential feature of the process was the formation of a mobile film which flowed over the surface of the material. Thus, even in the case of a hard brittle material, such as speculum metal, light polishing with the finger, or soft leather applied by hand, was capable of imparting temporary mobility to a surface layer of molecular thickness which, while in the mobile condition, behaved like a viscous liquid. The mobile layer readily flowed over scratches and other slight imperfections in the surface and, being smoothed out by surface tension forces, produced the mirror-like surface of a liquid which would appear to be the essential condition of polish. The existence below a polished surface of scratches covered over by the flowed film had been demonstrated by light etching, which dissolved the film and revealed the scratches which had been visible prior to polishing. The production of a flowed film was not confined to readily fusible substances, but could readily be produced on an infusible material, such as calcite, so that the temporary mobility would not appear to be due to partial melting of the surface layer.

For equal degrees of roughness, smoothing would be more difficult to effect in the case of a hard deposit owing to its greater resistance to plastic movement under pressure of the polishing wheel. In any questions involving relative ease of polishing (considered apart from abrasion) due consideration must be given to the roughness of the surface as well as to the mechanical properties of the deposits concerned.

Hardness of Nickel Deposits.—Using identical depositing conditions, it is possible to produce two well-defined types of nickel deposit of widely different mechanical properties in two different types of solutions. Evidence is adduced in the paper to show that the author's views concerning the hardness of nickel deposits depending on the presence of ammonium salts in the plating solution, which is based on quantitative tests, and the contrary view of other workers, which would appear to be based upon the behaviour of the deposit during polishing, may be reconciled if it is accepted that ease of polishing, instead of being indicative of softness, is actually in this case indicative of hardness with associated smoothness.

Radio Direction-finding.

An account of the recent development of apparatus devised at the Radio Research Board's station at Slough.

By R. H. BARFIELD M.Sc. (Eng.), A.M.I.E.E.

(*Extracts from a paper read before the* Wireless Section *of the* Institution of Electrical Engineers.)

RADIO direction-finding apparatus based on the closed-loop principle (in fact, all existing systems which are employed in a practical capacity as an aid to marine and aerial navigation) is subject to a very serious inherent limitation, or defect. It does not determine the direction of travel of the waves, but only that of the resultant horizontal magnetic field of the waves. When measuring the ground ray of a wave alone these two directions are at right angles, but when receiving waves which have travelled *via* the Heaviside layer, some of which arrive from the upper atmosphere with horizontally-polarised components, there is no necessary relationship between them. In fact, those systems are entirely unreliable as direction-finders under such conditions.

The first attempt to produce an instrument not subject to this limitation was made in 1916 by Adcock, who pointed out that a directional receiving system consisting of spaced vertical aerials should theoretically determine the true direction of travel under all circumstances. He actually constructed such an apparatus and demonstrated the improved nature of the results to be obtained with such a system, though his work was not actually published until after the lapse of several years.

During that time attempts were being made at Slough to produce a direction-finder free from the defect described above, which might be conveniently designated "horizontal effect"; a direction-of-travel finder as distinct from a direction-of-field finder. A system based on Adcock's principle was in due course produced which was almost completely free from "horizontal effect"; however, it relied for its success on the suspension of the hut containing the operator and apparatus at a height of some 20 ft. above the ground.

Part (1) of the paper describes a four-aerial system erected near Slough, supported by a single central mast instead of four separate ones, and gives details of the tests carried out on wave-lengths of 300 to 600 m. The modification introduced consists of the insertion of balancing condensers in the earth leads, and corrects the asymmetry of the aerial system with respect to its upper and lower portions, which is unavoidable if the operating hut is at ground-level. In the first test the performance of the new system was compared with that of a rotating-loop-finder over a prolonged period, which included conditions of most severe "night effect." In the second test calibration of the system was made by means of a transmitter attached to a kite, which provided a source of down-coming waves of known angle of incidence and polarisation.

The results show the new system to be considerably superior to the closed-loop system for conditions of "night effect." They indicate, however, a residual instrumental error in the presence of down-coming waves. A further modification by which it is hoped this error will be eliminated is described. In every case it is the horizontal leads which give rise to the error, and, although balancing by condensers results in great improvement, it has been demonstrated in at least one case to leave residual imperfections. It therefore appears that a perfect system would demand the abolition of these leads altogether, which may be virtually achieved by substituting for them a series of magnetically-coupled circuits, each occupying a comparatively short length of space between the aerial pairs. The actual number of "links" in the chain is theoretically greater the more perfect the system becomes. Development of the Adcock system therefore involves in the first instance the testing of this principle, and it will be attempted if occasion arises.

Part (2) of the paper describes two distinct types of portable short-wave direction-finding apparatus, and gives details of the methods by which they were tested and compared under working conditions at wave-lengths of 12 to 60 m. One instrument is of the totally-screened closed-loop type, and the other is of the rotating Adcock type, consisting of a single pair of spaced vertical aerials pivoted about a vertical axis.

The tests were divided into four sections: (*a*) for instrumental error with a local transmitter situated first on the ground and then elevated 40 ft. above the ground, with its aerial at various angles to the vertical to give waves of varying polarisation; (*b*) on the effects of the immediate surroundings of the receiver; (*c*) direction finding observations on the "ground ray" of a transmitter up to the maximum distance at which the ray was detectable; (*d*) long-range tests at which only down-coming waves were being received.

Test (*a*) showed the Adcock aerial to be much superior to the loop in the presence of down-coming horizontally polarised waves, while (*b*), (*c*), and (*d*) showed that for observations on the ground ray both instruments are equally satisfactory, and that with due precaution in the choice of a site their performance is much the same as that of longer-wave apparatus. For observations just outside the range of the ground ray

both systems are equally useless, while at greater ranges (beyond the "skip distance") the results again demonstrate the superiority of the Adcock aerial to the loop.

The results generally confirm the conclusions with respect to the nature of the propagation of the waves arrived at by Eckersley from somewhat similar experiments.

Indian Electrical Notes.

[By Our Indian Correspondent.]

The Development of Communications.

In his speech as chairman at the annual general meeting of the Indian Radio-Telegraph Company held in Bombay recently, Mr. C. N. Wadia expressed pleasure at the continued progress of the company, and mentioned that the figures of the transmitted and received messages in all the branches of the Beam telegraph service during the past year exhibited a marked improvement. A significant feature of this traffic was the large proportion of the ordinary or full-rate messages which were mostly sent in code. There was also a marked increase in the cheaper classes of messages, such as "daily letter telegrams." The company's service, however, suffers from the handicap due to the absence of its own land lines between Bombay and Calcutta and Bombay and other large commercial centres in India.

Marconi's Wireless Telegraph Co., Ltd., which is the largest shareholder of the Indian company, has submitted to the consideration of the directors of the latter concern a scheme for the formation of a Communications Company in India with a view to merging the cable and wireless interests of the Government of India, the Eastern Telegraph Company, and the Indian Radio-Telegraph Co. at the eastern end, and in consequence thereof the directors of the latter company are at present in communication with the Government of India to know its views in this matter.

The question of extending the present radio service, in the first instance to Japan, continues to engage the attention of the board which is now in communication with the Government of Japan and the Japan Wireless Telegraph Company who are anxious to see an Indo-Japan Beam service inaugurated and commenced early in 1931. To obtain the necessary licence, the Government of India has been approached.

As regards the establishment of a system of radio-telephony between India and Great Britain utilising the Beam, the chairman informed the shareholders that the British Government was not favourably inclined towards the use of the Beam for this purpose, and wished to utilise the high-power station at Rugby. So far as the trading business of the company was concerned, that branch has not yet been satisfactory due to the uncertainty of the future of broadcasting in India. The meeting approved of the directors' recommendation to pay a preference dividend at the rate of 7 per cent. per annum, and to distribute Rs. 297,000 as dividend on the ordinary and deferred shares.

Hydro-electric Power for Bengal.

At the annual meeting of the Indian Institution of Engineers held in Calcutta recently, Mr. Weston, the Director of Industries, Bengal, referred to the lack of hydro-electric power enterprises in Bengal, and pleaded for the investigation of the possible sites in that province. He referred particularly to the Teesta River, which flows through a gorge into the plains at Sevoke, 13 miles to the north-east of Siliguri, where, according to him, nearly a quarter of a million kW would be available. This is a perennial snow-fed river, and the power would never fail. He therefore proposed the undertaking by the Government of an authoritative investigation by competent hydro-electric and civil engineers as to whether a dam was not practically feasible within the gorge, which would concentrate the river flow and permit the use of the 320-ft. fall between its junction with the Rungit and its emergence at Sevoke.

If the results of the investigations were good, then the Industries Department could lay plans for the future industrial and economic development of the province by planning and working for an electric power grid distributing system feeding into it power from the hydro-electric station of the Teesta at one end and from the fuel resources of the coal-fields at the other. The system would distribute the power required for the railways and forest ropeways, the tea gardens, the rice mills, the jute presses, the irrigation pumps, water supply, sanitation schemes, and the rural industries. Such a programme of development would not be out of place in a province which has witnessed many changes in its features and history during the last century, and would certainly place Bengal in the van of engineering progress.

Legal.

Abertillery Theatres, Ltd., v. Abertillery U.D.C.

At the Abertillery County Court last week the plaintiffs in this case claimed £40 damages for loss of takings and injury to plant caused by the alleged negligence of the Abertillery Urban District Council and its failure to supply electricity. Mr. Lloyd Davies, for the Council, said that the plaintiffs were ordinary consumers, having no special contract with the Council, and could not therefore claim damages. His clients could be penalised for failure to supply electricity, but the case would have to come before another court. Mr. Morgan Evans, for the plaintiffs, said that they alleged negligence as well as failure to supply. The Judge said that the only remedy was the one mentioned by the defendants' counsel, and dismissed the claim with costs.

Warren v. Derbyshire & Notts. Electric Power Co.

A King's Bench Divisional Court consisting of the Lord Chief Justice and Justices Avory and Branson, on April 3rd heard an appeal by Mr. J. H. Warren, an inspector under the Factory Acts, against the refusal of the Derby magistrates to convict the Derbyshire and Nottinghamshire Electric Power Co., of the alleged offence of neglecting to take necessary precautions with regard to certain conductors carrying electricity at a high voltage.

The Attorney-General (Sir William Jowitt, K.C.), in support of the appeal, said that at the respondents' generating station at Spondon, Derby, there was a trifurcating box which was usually covered by a cage. In May last a workman named House was engaged in brushing down a portion of the equipment and part of the front of the cage was removed. He was working within a foot of one of some leads insulated with Empire tape. Touching one of the cables with the brush, House received a fatal electric shock. It was stated that the cage was only removed from the centre part of the apparatus, and that that part was "dead," but the conductors on each side were "live." House knew the dangerous nature of the work, and, moreover, had been warned. The justices declined to convict, holding that the conductor was protected. The contention of the inspector was that the conductors were not sufficiently insulated, and that sufficient safeguards had not been taken to protect a workman even though he was careless. The fact that House was killed proved that the insulation was not sufficient.

Sir Henry Maddocks, K.C., for the respondents, said that House was employed by contractors who were adding to the plant for the power company. He received no instructions from the respondents. It was not practicable to render the adjacent cables "dead." The Empire tape used to insulate the leads was admitted to be an adequate insulator, and no fewer than six layers had been used. House must have stretched his arm across the "live" cables accidentally and punctured the insulating tape. The prosecutor produced the brush, and pointed out that it had metal on it that might have cut the insulating tape.

Their Lordships allowed the appeal with costs.

The Lord Chief Justice stated that the Act said that conductors should either be covered with insulating material and be sufficiently protected when necessary to prevent danger, or they should be placed and safeguarded so as to prevent danger so far as was reasonably practicable. The Derby Justices found that both those provisions had been carried out. But no transverse screens protected the workmen from the "live" cables although that precaution could have been carried out. It seemed obvious that transverse screens might have prevented the accident. That fact was fatal to the respondents' case. Consequently there were no materials on which the Justices could refuse to convict the respondents and the case would go back for conviction.

Justices Avory and Branson concurred.

Urban Electric Supply Co., Ltd., v. the Liquidator of George Black & Sons, Ltd.

In the Companies' Court, last week, Mr. Justice Maugham heard an application by the Urban Electric Supply Co., Ltd., that the decision of the liquidator of George Black & Sons, Ltd., Berwick-on-Tweed, rejecting its proof for a debt under an agreement to supply electricity, be reversed and the proof admitted.

Mr. H. I. P. Hallett, for the applicants, said the matter arose under an agreement dated May 5th, 1921, clause 5 of which stated that the company should take and pay for electricity to the value of not less than £1,500 during the first five years from the date of the commencement of the guarantee, and electricity to the same value during the next five years, and if the sums paid or owing for current actually supplied should not amount to £1,500 during either period, the company should pay by way of liquidated damages such further sum as would bring the total to £1,500. The liquidator rejected the proof on the ground that the clause was a provision for a penalty, and as such was unenforcible. Affidavits filed on behalf of the liquidator stated that under this clause the company would have to pay in full for the supply whether it

had it or not. That was a complete misapprehension. The view of the applicants was that to give a guaranteed supply they had to have the necessary generating plant and machinery, which must give the supply at any time it was required, and they therefore wanted to be assured of a return on the money which they had locked up in that plant and machinery. They therefore asked for a certain sum per year. It was considered that that was a reasonable and sensible commercial bargain.

Mr. Norman Danes, for the liquidator, contending that the clause in question amounted to a penalty, said that an agreement to take a minimum quantity of electricity and pay for it, whether it was used or not, was an unconscionable state of affairs.

His Lordship, giving judgment, said that the sum payable under the clause was not in the nature of a penalty, and could not be regarded as a pre-estimate of damage. The decision of the liquidator was wrong, and he directed that the proof be admitted for £2,955, less certain agreed deductions.

Winding-up Petitions.

Foundation Co., Ltd.—In the Companies Court on Monday last, Mr. Justice Maugham, on the application of Mr. Palmer for the company, agreed to a stay of a winding-up order made on March 31st, for a period of six weeks.

Mr. Palmer explained that the company did not enter an appearance against the order, believing that the petitioning creditor had consented to an adjournment. All parties now agreed to the stay asked for.

British Talking Pictures, Ltd.—Mr. Justice Maugham on the same day sanctioned a scheme of arrangement by the British Talking Pictures, Ltd., with its creditors, at the same time dismissing the petition of the Chloride Electrical Storage Co., Ltd., for the winding-up of the company, this being one of the terms of the scheme. Another term was that £25,000 was to be raised within two months of the scheme being sanctioned, and his Lordship said if that sum was not raised then the scheme would not bind the creditors.

Mr. Gordon Brown, for the company, said there was no danger of that, as the creditors were taking control of the company.

Gramophone Cabinets, Ltd.—The petition of the London Electrical Co., for the compulsory liquidation of this company, again came before Mr. Justice Maugham in the Companies Court on Monday, and was adjourned for two months to complete the details of a scheme of reconstruction of another company, as the result of which, said Counsel, the respondent company would be in a position to receive £5,000, which would pay the company's creditors.

Claim by the Irish Electricity Supply Board.

In the Dublin High Court last week, Mr. Justice Johnston commenced the hearing of an action by the Electricity Supply Board, Dublin, claiming a declaration that a sum of £6,035 standing to the credit of the Rathmines and Rathgar Urban District Council on account of its electricity undertaking was now vested in the Board. The action was taken against the National Bank, Ltd., and the Council. It was stated for the plaintiffs that the electricity undertaking having now been acquired under the Electricity Supply Act, 1927, the funds of the undertaking were transferable to the Board. The case of the Council was that the sum in dispute had been appropriated for the benefit of the rates. The hearing was to be resumed on Tuesday last.

Parliamentary News.

[By our Special Parliamentary Reporter.]

The Severn Barrage.

On April 2nd, Captain Gunston asked the Minister of Transport if he would state when the committee which was examining the question of constructing a tidal barrage across the River Severn for the purpose of an electrical power scheme was expected to report.

Mr. Herbert Morrison, Minister of Transport, replied that it was expected that the further investigation undertaken by the Committee would take about two years to complete.

The Dorking Electricity Order.

On April 2nd, Mr. Ede asked the Minister of Transport if he would state when he anticipated being able to announce his decision on the inquiry held last July into the Dorking Electricity Order.

Mr. Herbert Morrison said that he was not satisfied that the proposals of the Order as it stood were in the best interests of the development of electricity supply in Dorking and neighbouring areas, and at his request the position was being discussed by the Electricity Commissioners with the promoters and other parties concerned with a view to making further proposals.

Electricity Inquiries.

On April 2nd, Mr. Ede asked the Minister of Transport if he would state how many public inquiries were held during 1929 by his Department into applications for Electricity Orders or for extensions of Electricity Orders; and in how many such cases had no decision yet been announced.

Mr. Herbert Morrison replied that four such inquiries were held during 1929, and in one case no decision had yet been announced.

Electrical Voting Apparatus.

On Wednesday, April 2nd, Mr. Perry asked the First Commissioner of Works if his attention had been called to the new electrical voting apparatus which was to be tried in the French Chamber of Deputies; and whether, in view of the time occupied in recording divisions, he would consider whether such a system could be introduced into the House.

Mr. Lansbury said that he had seen references in the Press to the apparatus mentioned. The question as to whether such a system should be introduced was a matter for consideration by a committee of the House.

Improvement of the Telegraph System.

On April 1st, Sir Nicholas Grattan-Doyle asked the Postmaster-General whether he was in a position to state which of the recommendations of the commission of inquiry to the United States to investigate the organisation and method of working of the American telegraphic system were to be adopted and put into operation.

The Postmaster-General replied that in conformity with the recommendation of the commission, teleprinter apparatus was being installed as rapidly as it could be obtained from the manufacturers, and a number of changes were being introduced in the organisation and layout of instrument rooms. Some of the recommendations of the commission involving important changes of organisation and methods were under discussion with the Post Office staff associations whose interests were affected, and others were the subject of practical experiment.

On March 31st, Captain Cazalet asked the Postmaster-General whether he contemplated taking any steps to carry out the recommendations of the D'Abernon report with regard to the excessive charges for telegraphic communications between this country and South America.

The Postmaster-General answered that he had noted the complaints of the D'Abernon Mission that the cable and radio rates from Argentina to London were higher than the rates to New York and Berlin, and that the matter called for immediate attention. This, however, was not a case in which the Post Office could lower the rates, as they were not Post Office services, but services carried out by the Imperial and International Communications Company. The matter was under the consideration of the Imperial Communications Advisory Committee, which had certain functions with regard to the company's rates.

Electric Furnaces.

Chemical engineers visit Birmingham and discuss methods of heat-treating non-ferrous metals and alloys.

(Report of a meeting of the Society of Chemical Industry.)

The members of the Birmingham and Midland Section of the Society of Chemical Industry held their annual joint meeting with the Chemical Engineering Group from London at Birmingham. In the afternoon a visit was paid to the works of the General Electric Co., Ltd., and in the evening there was a lecture by Mr. A. G. Lobley, M.Sc. (Birmingham) on "Electric Furnaces for Heat Treatment," at the Chamber of Commerce, there being a large attendance. A dinner followed.

Dr. H. W. Brownsdon presided at the meeting (in the absence of Mr. W. A. S. Calder) and said there was no doubt that electric furnaces for use in the non-ferrous metal industries had come to stay. They were growing steadily in popularity, but not infrequently there was some delay in obtaining the equipment.

Mr. A. G. Lobley pointed out that improved heat-treatment methods were essential to modern industry, and in many cases could be obtained by means of electric furnaces with greater certainty and convenience than with other type of furnace. Having flexibility, it was possible to adapt the design of the furnace and charging arrangements to the nature of the process and to place the furnace exactly where it was required, in the line of flow of the material. It was not always easy, the lecturer pointed out, to assess the exact influence of such advantages on works costs, and it was unfortunate that the prospective user often overstressed the cost of electrical energy used. The suggestion was often made that electricity was more expensive than coal or coke, fuel oil, producer gas, or coal gas, but such a comparison was fallacious and incomplete. The cost of gas per therm did not deal with energy

in equally accessible states; electricity could be converted into accessible heat, which was not the case with energy derived from fuel combustion. It seemed to him that efficiency percentages were an important consideration; while agreeing that every case must be considered on its merits (in that the efficiencies of all furnaces varied considerably with the process involved) his contention was that an unassailable case had been made out for the electric furnace.

Compare the cost of heating, by gas and by electricity, a charge up to a given temperature and maintaining it at that temperature, observed Mr. Lobley. Take the average efficiencies of two modern furnaces in good condition: an electric furnace of 110 kW rating and having a hearth 3 ft. 9 in. by 7 ft. and a similar gas furnace. The costs were based on electricity at 0.6d. per kWh and gas at 2s. 6d. a thousand feet (or 0.5d. and 2.1d.). By the time the charge was heated through, the cost was practically the same, but the maintaining cost was lower with the electric furnace. The gas furnace on which those results were based was a recuperative one of the latest type erected in 1928, and since improved. As a result of competition from the electric furnace, a very much improved gas furnace had been made which was said to maintain at about 250 cu. ft. per hour instead of 450 cu. ft. Even at the reduced rate, the maintaining cost was more than with the electric furnace, with the above prices of energy.

Whilst the consumption of electrical energy was heavy at the start, owing to the rapidity with which heat could be forced into the furnace, it was very small during the maintaining period. The low consumption required to maintain the temperature, or balance the heat losses, was due to the fact that it was possible to heat the furnace very efficiently and there was no other way for the heat to be lost. In a fuel-fired furnace there was the additional (and usually considerable) loss up the flue. It might be thought that in some operations, such as re-heating, when the charge had only to be brought up to temperature and not held there, that gas would then be in a superior position regarding cost. Actually that was not the case, partly because gas re-heating furnaces had not usually as high an efficiency as the example quoted and partly because the loads were usually lighter.

What really mattered, urged Mr. Lobley, was the cost of the heat that was usable. The relative costs depended on the type of process, and due regard should also be had for the quality of the work done.

Lantern slides illustrating electric-furnace installations in this country and America were shown, and points of interest regarding them were described. A number of them consisted of box-type furnaces for annealing, carburising, and general heat treatment. Among other types were the following:—A rotary annular hearth furnace for re-heating gears; the time of treatment was definitely controlled as well as the temperature. A small pusher type furnace with sealed chute for semi-bright annealing. A continuous rotary drum furnace of new and patented design for annealing small brass parts; a special feature of this furnace had reduced the current consumption to less than half of that of other types; it was automatically fed and did away with the necessity for pans. Two bright annealing furnaces with lift-off tops were also illustrated, and an entirely new continuous furnace having a driven roller hearth, which was also being used with a special atmosphere for bright annealing.

The lecturer pointed out that, whilst the elements, or resistors, in the case of large furnaces could not be external, there were considerable differences in practice between different makes. Various degrees of muffling or shielding lay between the extremes of the completely open resistor to radiate in all directions and the element completely covered with some refractory shield. He, personally, believed in a free radiating element; the shield resistor was protected from accidental damage and was neat, but low loadings per unit of wall surface were essential in order to prevent the overheating of the element. In many cases low loadings were sufficient, particularly in small furnaces, but as a general practice he preferred a method which enabled the highest possible rates of heating to be used when necessary.

Describing a section of box-type furnace adapted for use with a charging machine, Mr. Lobley pointed out that the resistors, which were made of strip, were supported by a patented method of nickel-chromium hooks. In that way not only was radiation completely free, preventing hot spots which might occur when the element was supported on refractory, but also all risk of interaction between the element and the refractory was avoided. In practice, failure of heating elements was almost entirely due to interaction, particularly in the presence of reducing gases.

A discussion followed, in which Mr. Fallon contended that carbonising furnaces, with oil or gas, were quite effective, and added that in the case of large electric furnaces the opening of the door was a source of loss. He had full confidence in the modern fuel furnaces.

Prof. W. Cramp inquired if it were not practicable to make use of the induction furnace for the heat treatment of non-ferrous metals, but Mr. Lobley said the standard of all-round efficiency was not, comparatively speaking, quite satisfactory.

Mr. Talbot agreed that a good case had been made out for the electric furnace for many classes of non-ferrous work. The fuel furnace also had its own field, and so had producer gas, for dealing with ferrous material; in modern equipment the flue gases were utilised.

Correspondence.

***Correspondents should forward their communications as early as possible.** No letter can be published unless we have the writer's name and address in our possession.*

The B.E.A.M.A. and the Universities.

In trying to account for our difficulty in meeting the competition of America, the B.E.A.M.A. has overlooked the principal cause. Its policy has accordingly been misdirected, and a great amount of its money has been spent in a way that has done more harm than good. The following statement of the case is necessarily brief, but I shall be very pleased to give full details to any member of the B.E.A.M.A. Council who feels disposed to co-operate with me in putting the matter right.

The American student of electricial engineering receives a good scientific training, based on the work of Steinmetz; this is a matter of the utmost importance to a student who thinks of doing any original work himself. But while the American students have been taught in this way for a good many years, our own students have been hindered and misled by the obsolete ideas that survive in English universities. It follows that when we try to imitate America by establishing research laboratories, we are handicapped for want of men who can make proper use of them.

This unfortunate state of affairs is not due to any inferiority on the part of the English student, but is entirely the fault of his teachers. When suitably taught, he can quickly be made to understand the most difficult writings of Steinmetz, and even to correct them in some of the cases in which Steinmetz was led astray. I have proved this on several occasions by giving short courses of lessons to English students who had despaired of ever understanding such matters.

At first I thought that our universities would like to know how this was done. I soon found, however, that they not only objected to improvements in their general methods, but even objected to corrections of their teaching where it was indisputably wrong. The following instance is a good example of what I mean, and may save the reader from making serious mistakes.

Students of electrical engineering, in America as well as in England, are usually taught that $f(x)$ cannot be a maximum or minimum when $f'(x)$ and $f''(x)$ are both zero, for this mistake was made by Steinmetz as well as by our Professor Perry and his colleagues at the Board of Education. The argument on which this rule is based assumes that the graph of a function must have a positive slope at any point where it crosses from below to above the x-axis. But the incorrectness of this becomes clear as soon as attention is drawn to the matter, for x^3 is a well-known function whose slope is zero at the point in question.

As soon as I noticed this, it was easy to arrive at a simple and correct rule, namely:—When $f'(x)$ and $f''(x)$ are both zero, $f(x)$ will be a maximum, a minimum, or neither, according to whether $f''(x)$ is a maximum, a minimum, or neither. This tells us, for example, that $x+2\cos x$ is a minimum when x is zero, which contradicts the usual rule. The fact that the new rule gives the correct result in this instance can be verified on replacing $\cos x$ by the well-known series for that function.

The incorrect rule appears in a book published by one of our leading universities and written by a man who was teaching at another. I have repeatedly pointed out the fact of the matter to each of these universities, but neither of them has ever acknowledged the error; and I recently found that one of them was still misleading its engineering students with the old rule, more than six years after receiving my first intimation that this rule was altogether wrong.

As a result of my correspondence with these and other English universities, I am able to suggest a simple and inexpensive method by which the B.E.A.M.A. could soon effect a great improvement. It would merely be necessary for the B.E.A.M.A. to establish an education department of its own, which it could do with a small fraction of the money that it would otherwise give to the Electrical Research Association. The benefit of this would soon be felt by the E.R.A. itself; for the slow progress hitherto made by that Association is chiefly due to the want of such men as the Education Department could supply. An improvement in the university teaching would naturally follow; for the professors could not long continue with their present methods in face of the much better results produced by the methods of the B.E.A.M.A. Education Department. If any professor showed signs of doing so, his obstinate adherence to wrong teaching could be held up to ridicule every month in *World Power*, and occasionally in other technical journals. From what I have ascertained with regard to the psychology of these professors, I feel sure that a few months of this treatment would be all that was required.

W. F. Dunton.

Manchester, *April 6th*, 1930.

Bulk Supply Charges.

I note that from time to time you publish in your columns information pertaining to bulk supplies and very occasionally the cost at which they are being given.

I feel that it would do a great deal of good if Electricity Departments, as a whole, would publish their figures more freely, particularly the terms at which they are offered bulk

supplies; we might then arrive at some degree of uniformity, which appears to be entirely absent at present.

In our case, we have just been given permission to install a further Diesel alternator this year, and we have ordered a double-acting two-stroke Richardsons-Westgarth engine, guaranteed to give 1,050 kW for two hours, for £8,750, complete with alternator and switchgear cubicle. We hope to put in the foundation for £300, which will give us a total cost of £8.6 per kW installed and, if the Commissioners give us a twelve year loan period in which to pay this off, the capital charges per annum at 5 per cent. interest with repayments come out at £1.02 per kW. As against this we are quoted by the Power Co. from the Grid £4 4s. per kW and 0.2d. per kWh, we to run the main to our boundary at an approximate cost of £10,000. When we bear in mind that with our own plant the engine will be paid for in twelve years and the capital charges will then cease and that in the case of the bulk supply the £4 4s. per kW goes on indefinitely, there does not appear to be much comparison, at any rate so far as the peak load part of the job is concerned.

Apparently the prices quoted for electricity supply from the Central Electricity Board, either indirectly or directly, vary with the geographical position of the recipient. I believe the Board is empowered to make levies for its management expenses, and it will be interesting to see whether these levies are at a uniform rate per million kWh sold by each undertaking or whether the undertakings who have been unfortunate in their geographical position will be given easier terms to make up for the higher prices which they are being charged for energy.

If all undertakings interested in bulk supply would publish the offers which are made to them freely, I think it might do a lot of good. At present, as far as one can see there is a tendency for the sellers to get what they can in individual cases without much reference to the cost of giving the supply.

H. Wilson.

Ashford, Kent, *April 7th*, 1930.

Published Specifications.

Compiled expressly for this journal by a firm of Chartered Patent Agents. The numbers in parentheses are those under which the specifications will be printed and abridged and all subsequent proceedings taken.

1928.

26,061. "Methods of treating electrically insulating materials." British Thomson-Houston Co., Ltd. September 12th, 1927. (297,635.)

26,496. "Electric furnaces." A. Sadler (G. B. Shipley and H. Alinder). September 15th, 1928. (326,517.)

29,871. "Inductance coils and frame aerials used in wireless reception." W. Henschler. October 16th, 1928. (326,522.)

33,065. "Electric switchgear." British Thomson-Houston Co., Ltd., H. Trencham, and T. Hands. November 12th, 1928. (Cognate application, 37,780/28.) (326,466.)

33,250. "Connecting lead device for electrical apparatus." J. R. Barden. November 13th, 1928. (326,484.)

33,959. "Lightning arrestors or surge absorbers." S. Z. de Ferranti and Ferranti, Ltd. November 20th, 1928. (326,557.)

35,809. "High-tension electric cables." E. L. Wildy and London Electric Wire Co. & Smiths, Ltd. December 5th, 1928. (326,486.)

36,301. "Sound-reproducing devices." British Talking Pictures, Ltd. December 10th, 1927. (302,161.)

36,459. "Apparatus for producing ultra-violet rays." E. O. Scheidt and Foodstuffs Irradiation Co., Ltd. December 10th, 1928. (326,532.)

36,563. "Electrical resistors." Electrad, Inc. December 17th, 1927. (303,578.)

36,568. "Electrically-heated tobacco lighters." J. Lucas, Ltd., and W. H. Eggington. December 11th, 1928. (326,455.)

36,595. "Electric telegraphy and like signalling systems." A. E. Telford. December 11th, 1928. (326,501.)

36,816. "Apparatus for producing high-frequency alternating currents by means of spark gaps." Dr. J. E. Scheel and W. H. Bull. December 13th, 1928. (326,534.)

37,024. "Electrical indicator." General Motors Research Corporation. March 28th, 1928. ((308,772.)

37,035. "Processes for the manufacture of piezo-electric, pyro-electric, and the like dielectrics." Telefunken Ges. für Drahtlose Telegraphie. December 21st, 1927. (302,726.)

37,117. "Apparatus for the electrical reception of pictures, diagrams, and other representations." G. Priechenfried, Wireless Pictures (1928), Ltd., and O. Fulton. December 15th, 1928. (326,544.)

37,624. "Call-announcer arrangements for semi-automatic telephone systems." Standard Telephones and Cables, Ltd., and E. P. G. Wright. December 20th, 1928. (326,563.)

37,625. "Automatic and semi-automatic telephone exchange systems." Standard Telephones and Cables, Ltd., and E. P. G. Wright. December 20th, 1928. (326,564.)

37,692. "Picture and the like telegraph apparatus." G. M. Wright and S. B. Smith. December 20th, 1928. (326,565.)

37,695. "Submarine cables or like transmission lines." W. S. Smith, H. J. Garnett, H. C. Channon, and J. N. Dean. December 20th, 1928. (326,566.)

37,716-17. "Telephone systems." Standard Telephones and Cables, Ltd., and T. S. Skillman. December 20th, 1928. (326,570-71.)

37,718. "Variable electric condensers." Standard Telephones and Cables, Ltd., and F. N. Scaife. December 20th, 1928. (326,572.)

38,209. "Supervisory signalling system for toll telephone service timing." H. Onishi. December 28th, 1927. (303,116.)

38,296. "Dynamo-electric machines." L. Mellersh-Jackson (Sunlight Electrical Manufacturing Co.). December 28th, 1928. (326,582.)

38,469. "Telephone systems." B. S. Cohen. December 31st, 1928. (326,584.)

38,502. "Thermionic amplifying systems for use in sound-reproducing apparatus." British Thomson-Houston Co. Ltd. December 31st, 1927. (303,382.)

1929.

789. "Step-by-step mechanisms." General Electric Co., Ltd., and A. E. Angold. January 9th, 1929. (326,591.)

1,837. "Electrostatic sound reproducers or transmitters." United Reproducers' Patents Corporation. October 24th, 1928. (326,602.)

1,871. "Television and the like." J. H. O. Harries. January 19th, 1929. (Cognate application, 8,657/29.) (326,603.)

2,029. "Commutator for use with electric filament lamps." M. Leff. January 21st, 1929. (326,606.)

2,042. "Automatically adjustable headlights for power-driven vehicles." F. Benisch and E Zahradnik. January 21st, 1929. (326,607.)

2,522. "Sound amplifiers or loud-speakers." M. Ward. January 24th, 1929. (326,614.)

2,621. "Thermionic tubes." C. J. R. H. Von Wedel. January 25th, 1929. (326,617.)

5,572. "Construction of electric switchgear." H. F. Yelland and Johnson and Phillips, Ltd. February 20th, 1929. (326,638.)

6,557. "Electric annealing or like furnaces" P. Mene. February 29th, 1928. (306,969.)

6,979. "Telephone instruments S. Dunlop (H. Fuld & Co. Telephon-und-Telegraphenwerke Akt. Ges. March 4th, 1929. (326,655.)

7,035. "Radio transmitters and the like" Telefunken Ges. für Drahtlose Telegraphie. March 3rd, 1928. (307,310.)

7,205. "Electric motors." British Thomson-Houston Co., Ltd., and H. Dreghorn. March 5th, 1929. (326,657.)

7,622. "Devices for measuring the electrical conductivity and concentration of acid or salt solutions." J. Carpentier Ateliers. April 3rd, 1928. (309,025.)

8,216. "Electric voltage indicators." Naamlooze Vennootschap Philips' Gloeilampenfabrieken. April 14th, 1928. (309,576.)

8,228. "Electric accumulators." H. Elsner. March 17th, 1928. (307,927.)

8,484. "Sparkless commutator chiefly for phonograph motors." Etablissements Igra. March 24th, 1928. (308,589.)

8,989. "Electrical flat-irons with thermo-switches." F. Gractz. March 20th, 1929. (326,665.)

9,430. "Electric circuit-controlling apparatus." British Thomson-Houston Co., Ltd. March 23rd, 1928. (308,615.)

9,706. "Telephone systems." Siemens Brothers & Co., Ltd., and C. L. Peters. March 26th, 1929. (326,672.)

9,925. "Valves for air-controlled collectors used in electric traction." C. W. Merrick and Brecknell, Willis & Co., Ltd. March 27th, 1929. (326,675.)

11,339. "Reinforced lead-covered electric cables." T. Harden and H. A. Mepham. April 12th, 1929. (326,684.)

11,349. "Electric illumination for tents." A. Fabianke. April 12th, 1929. (326,685.)

11,817. "Directional aerial systems." Telefunken Ges. für Drahtlose Telegraphie. April 17th, 1928. (309,920.)

12,631. "Sewing machine in which an electric motor is arranged on the end of the main shaft." R. Mundlos. April 23rd, 1929. (326,691.)

12,935. "Combined motion picture projectors and sound reproducers." British Thomson-Houston Co., Ltd. April 26th, 1928. (310,476.)

14,415. "Manufacture of dry batteries." Soc. Anon. Electrochimique Phoebus and S. de Ploeg. May 8th, 1929. (326,704.)

15,754. "Means for feeding the wire in electric arc-welding machines." International General Electric Co., Inc. May 22nd, 1928. (312,237.)

19,155. "Television receiving apparatus." Telenor Akt. Ges. October 2nd, 1928. (326,729.)

20,175. "Electrical transmission of pictures." British Thomson-Houston Co., Ltd. July 24th, 1928. (316,179.)

22,895. "Circuit breakers." H. Trinkl and M. Hauser. September 7th, 1928. (318,614.)

25,587. "Electric cable systems." British Thomson-Houston Co., Ltd. August 22nd 1928. (317,796.)

Trade Mark Applications.

The following are among the recent applications for British trade marks. Objections against any of the proposed marks may be entered within one month from April 2nd:—

Philips. No. 494,881. Class 8. Rectifiers, rectifying and resistance tubes, battery chargers for accumulators, and battery eliminators. Philifood. No. 509,656. Class 13. Electric lamps and electric light fittings.—Naamlooze Vennootschap Philips Gloeilampenfabriek, Eindhoven, Holland. (British representatives: Boult, Wade & Tennant, 112, Hatton Garden, E.C.2.)

Chromolite. No. 507,473. Class 8. Apparatus for use in plating metals.—Metals Protection Corporation, Indianapolis, U.S.A. (British representatives: Dicker, Pollak & Mercer, 20-23, Holborn, E.C.1.)

Eye (design only). No. 509,786. Class 8. Apparatus for use in transmitting images or scenes and/or sounds to a distance by telegraphy or telephony.—Baird Television Development Co., Ltd., 133, Long Acre, W.C.2.

Feno (lettering and design). No. 509,419. Class 15. Insulated connectors made of porcelain for electric cables and the like electrical conductors.—J. F. Schleper, trading as J. Schleper & Zonen, Amsterdam. (British representative: G. Ellam, 49, Gartside Street, Manchester.

Human Figure (design only). No. 509,929. Class 16. Engineering, architectural and building contrivances.—Electric Central Heating and Ventilating Co., Ltd., 157, West George Street, Glasgow.

Twinsulo. No. 510,476. Class 40. Wire covered with india-rubber.—A. Vandam & Co., Ltd., Caxton House, Tothill Street, S.W.1.

Melduro. No. 500,759. Class 50. Electrical insulating materials, made of synthetic resin, &c.—Metropole Developments, Ltd., Metropole House, Finsbury Square, E.C.2.

Copper-Steels for Transmission Towers.

It is now fairly well established that the use of steel containing small percentages of copper (of the order of 0.2 per cent.) establishes considerable resistance against atmospheric corrosion. In tests carried out in Germany upon steel sleepers for railway use, it was found that the loss of weight by corrosion of copper-bearing steel after a seven years' period of test was very appreciably less than with corresponding steels having no copper. In shipbuilding, too, the use of copper steel is expanding, especially for decks, erections, masts, and funnels exposed to severe atmospheric corrosion. One observer (Daeves, *Schiffbau*, Sept., 1928, p. 423) estimates that unpainted copper steel has from 2½ to 2 times the life of ordinary steel, and his tests showed that where copper-free steel had lost 70 per cent. to 90 per cent. of its thickness, copper-steel, under identical conditions, had only 4 per cent. wastage. In view of the high cost per mile of electrical transmission lines, and the necessity for prolonging their life and reducing upkeep, it is noteworthy that for the Central England Electricity Scheme transmission towers have been constructed of copper-bearing steel. The towers are manufactured by the Horseley Bridge & Engineering Co., Ltd., from copper-bearing steel supplied by the Frodingham Iron & Steel Co., Ltd., one of the branches of the United Steel Companies, Ltd.

New Work for Contractors.

Particulars of new works and building schemes for the use of electrical installation contractors in search of work and all interested in the sale of electrical and allied plant and other products.

Publication in this list is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

ASKRIGG.—Grammar school, Yorebridge, for North Riding E.C.; J. C. Wrigley, Education Offices, Northallerton.

BEXLEY.—Church, Brampton estate, with electrical work; G. E. Burgess, architect, Dartford. Additional 166 houses, Pickford Lane estate, for the U.D.C.; surveyor.

BIRMINGHAM.—Cinema, College Road, New Oscott; H. Robinson, architect, 6, Cherry Street. Waterworks and service reservoirs, Frankley; Corporation water engineer.

BLACKPOOL.—Hospital; borough engineer.

BOLTON.—Housing developments, Hulton Lane and Hawthorne Road; Stott & Sons, architects. Sessions Hall, library, museum, art gallery and town hall extensions; Bradshaw Gass & Hope, architects.

BRADFORD.—R.C. church; Rev. Father Ennis, St. Peter's.

BROMBOROUGH (Cheshire).—Picturedrome, Allport Lane, for F. G. B. Scadding, Spital Road.

CAERPHILLY.—Housing scheme (80), for the U.D.C.; surveyor.

CHELMSFORD.—Extensions, Science and art school, for the Essex E.C. (£25,055); T. J. Bailey, builder.

CHESTERTON.—Housing scheme (32), for the R.D.C.; housing officer, 12, St. John's Street, Cambridge (returnable deposit of £1 1s.).

CLITHEROE.—School (560 places), for the borough E.C.; director of education.

COLCHESTER.—Housing scheme (55), for the T.C.; H. Collins, borough surveyor.

CROOK.—Town Hall, for the U.D.C. (£18,000); Hicks and Charlewood, architects, Newcastle.

CROYDON.—Housing scheme (84), for the T.C.; borough engineer (returnable deposit of £5 5s.). Seven schools, for the borough E.C.; education officer, Katherine Street (returnable deposit of £1 for each school).

DROITWICH.—Housing scheme (40); R. E. Hulse, borough surveyor (deposit £2 2s.).

DUDLEY.—Houses (470), Priory estate; borough engineer.

DUKINFIELD.—Elementary school, Lakes Road, for the E.C.; T. Warrington, contractors, 51, Bennett Street, Hyde, Cheshire.

EARBY.—Installation of electric lighting at Alder Hill school, for the district E.C. (£130).

EAST LOTHIAN.—Waterworks, Hopes Valley, for East Lothian Western District Water Board; G. H. Hill and Sons, engineers, 40, Kennedy Street, Manchester.

EDINBURGH.—Completion of Hospital for Crippled Children, Farmilehead (£30,000); secretary.

FLEETWOOD.—School with electric heating installation, for Lancashire C.C. (£30,000); S. Wilkinson, county architect, 16, Ribblesdale Place, Preston.

GLASGOW.—Houses, Netherton estate (222), and Germiston estate (144); housing director. Bridges and roads, Glasgow-Edinburgh road (£150,000); Shanks & M'Ewan, Ltd., and A. M. Carmichael.

GLOUCESTER.—Eye institution, Royal Infirmary (£30,000); secretary.

GRAVESEND.—Additional 158 houses, King's Farm estate, for the T.C.; J. G. Bennett, borough architect, 5, Woodville Terrace (returnable deposit of £2 2s.).

GRIMSBY.—Two new schools and reconstruction of existing schools, for the Corporation E.C. (£260,000).

GUILDFORD.—Development of Henley Grove area; Onslow Village, Ltd. Houses (26), Worplesdon Road; R. C. Whitmore.

HESTON AND ISLEWORTH.—Extension to the premises of Firestone Tyre & Rubber Co. (1929), Ltd., Great West Road; Wallis Gilbert & Partners, architects, 29, Roland Gardens, Kensington, S.W.7. Houses (290), at Sion Park, for Chiswick U.D.C.; E. Willis, architect, Town Hall.

HIGH WYCOMBE.—Houses (28), Sands; P. W. Lowe. Flock mills, Sands, for H. Redfearn.

HOUGHTON-LE-SPRING.—Houses (64), for the U.D.C.; H. Balmer, builder.

HULL.—Pavilion, City Hospital (£8,079); J. H. Fenwick and Son, Ltd. Church, Bilton Road and Preston Street; Rev. S. C. Radley.

ILKESTON.—Houses (64), Northern estate (£20,100); R. J. Jewell & Son, Nottingham.

IRISH FREE STATE (Dublin).—Houses (641), Cabra housing area, for City Commissioners; city architect, Exchange Buildings, Lord Edward Street (returnable deposit of £5 5s.).

(New Ross, Co. Wexford).—Houses (23), for the U.D.C.; J. Shortall, surveyor.

(Galway).—Houses (50), at the Claddagh, for the U.D.C.; W. N. Binns, borough surveyor.

KIDDERMINSTER.—Housing scheme (86); J. Hawcroft, borough engineer.

KINGSTON.—Estate development off Bye-pass Road; J. J. Hodgson & Sons, Ltd., Tolworth.

KINGSWINFORD.—Housing scheme (60), Wordsley, for the R.D.C.; W. Meredith, surveyor (returnable deposit of £2 2s.).

KIRKCUDBRIGHT.—Gymnasium at Academy (£10,500); E. A. Hornel.

LEEDS.—Houses (78), and flats (56), Dewsbury Road estate; W. J. & R. Turnbull. Flats and houses, Southfield estate (£27,000); City architect.

LEITH.—Improvements at Leith Docks (£106,500); A. H. Roberts, superintendent of the docks.

LONDON (Leyton, E.).—Library (£13,400), for the T.C.; borough surveyor.

(Ilford, E).—Additions to King George Hospital, Hatch Lane; C. J. Dawson, Son & Allardyce. Houses (43), St. Leonards Gardens; T. Anders.

(West Ham, E.).—Fire station with shops (£24,000), and baths, with lounge, hall, and tea and club rooms (£185,000); borough engineer.

(Deptford, S.E.).—Pumping station (£230,000); L.C.C. chief engineer.

(Tooting, S.W.).—Remodelling Tooting Home (£22,500); L.C.C. architect.

METHVEN.—Sewage purification works; G. Thomson & Son, engineers, 164, Bath Street, Glasgow (deposit £2 2s.).

MIDDLESBROUGH.—Conversion of Acklam Hall into secondary school (£14,685), for the borough E.C.; director of education.

NORTHFLEET.—Converting old Southern Railway station to dwellings; R. Hopkins & Sons.

OLDBURY.—Schools and extensions (£82,750), for the E.C.; director of education.

REIGATE.—Housing schemes, Redstone (36), and Battlebridge (66), for the T.C.; borough surveyor.

SHEFFIELD.—Houses, Shire Green estate; J. Laver & Sons (132), and R. T. Hinchliffe & Son (94). Houses (40), Longley estate (£15,302); William Malthouse, Ltd.

SLOUGH.—Technical institute (£25,000), for Bucks. E.C.; director of education, Aylesbury. Maternity home (£5,786); H. D. Bowyer, builder.

STOKE-ON-TRENT.—Nurses' home (£39,900), for the B.G.; Gee, Walker & Slater, Ltd., builders, Derby.

STRATHAVEN.—Cinema theatre; W. Stewart, 4, Kirkland Park Avenue.

STRETFORD.—Library; the librarian.

TWICKENHAM.—Houses (72), at Fielding Avenue, for T.C.; G. R. King, borough engineer (returnable deposit of £2 2s.).

WALSALL.—Houses (78), Wolverhampton Road (£23,480); Abraham Smith, Bloxwich.

WARMINSTER.—School (302 places), for Wilts. E.C.; T. Walker, county architect, Trowbridge (returnable deposit of £2 2s.).

WARRINGTON.—Housing scheme (98), for the T.C.; A. M. Ker, borough engineer (returnable deposit of £2 2s.).

WILLINGTON.—School, Newfield, for Durham County E.C.; F. Willey, architect, 34, Old Elvet, Durham.

WORSLEY.—Senior school (£44,996), for Lancs. E.C.; county architect, Preston.

YORK.—Estate development, Huntington Road; Culliford and Tindall.